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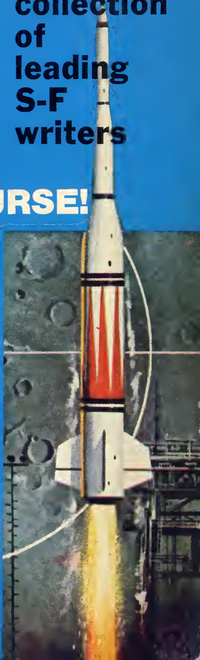

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editorial

Why haven't more "main-stream" writers recognized the rich emotional sources available in the "formal art" of science? This question, posed by science-fiction writer and critic Poul Anderson, becomes the starting point for his rambling-but-linked exploration of poetry, science, and fiction that serves as this issue's guest editorial. Without further ado, we turn this considerably expanded space over to Mr. A.:

CONVENTIONAL wisdom calls poetry at its best the highest form of literature. With this I have no quarrel. To be sure, if we go on to ask why it is so, what makes poetry the most exacting and most rewarding use of language, we could argue all night. That would be fun, but this is no time for me to write a book.

However, I might suggest that poetry has one outstanding characteristic. It puts the maximum amount of meaning into a given space. In those poems we generally concede to be the greatest ever written, hardly a word is wasted. This is obvious enough in a case like Japanese haiku. Even in translation, one can appreciate how much is said, and how much more implied, by something like Basho's

This road:
with no man traveling on it,
autumn darkness falls.

But I don't think there is any useless noise in Hamlet's soliloquy either, nor much in the entire play.

The words of a poem convey more than factual information. By their rhythms, by their interrelationships such as rhyme, by their associations and overtones, they come to mean enormously more than they ostensibly say. This is the source of poetic compactness.

My excuse for setting down these clichés is that modern com-

(Continued on page 42)

I HAVE NO MOUTH AND I MUST SCREAM

It was the computer's revenge. In rage, in frenzy, he turned us into monstrosities, imprisoning us deep inside his endless banks. Now I am a great soft jelly thing.

I have no mouth. And I must scream.

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COMPLETE
SHORT NOVEL

COLLISION COURSE

By
ROBERT
SILVERBERG

ILLUSTRATOR FINLAY

CHAPTER 1

ONLY a month before, the Technarch McKenzie had calmly sent five men to probable death in the name of Terran progress. But now, it seemed, those five men had not died after all, and McKenzie's normally rock-hard face now reflected inner tension.

The message, reaching him in the Archonate Center, had been brief. *"Luna detection center reports return to this system of the XV-ft1. Landing at Central Australia spaceport requested for 1200 hours EST."*

The Technarch read the message through twice, nodding. So

The Norglans could not control the tremendous force that whipped them into the air against their will.

they were back, were they? After a successful trip? By *the Hammer*, he thought, *we'll see men in the far galaxies yet! And in my Archonate, heaven willing!*

His nature was too stern to allow him more than a moment of gloating pride. He had gambled; he had won; and perhaps his name would ring in the galleries of history for millennia. The experimental faster-than-light ship was returning safely.

He depressed a communicator stud. "Set up a transmat connection to Central Australia spaceport right away, Naylor. Immediate departure."

McKenzie stared for a moment at the big, thick fingers of his hands as they lay before him on the desk. Hands like those could never wire a circuit, wield a surgeon's excising vibroknife, or tune the fine controls on a thermonuclear generator. But they were hands that could write, "*If we remain bound forever to the limiting velocity of light, we will be as snails seeking to cross a continent. We must not be lulled into complacency by the slow expansion of our colonial empire. We must surge ever outward; and the faster - than - light spacedrive must be the be-all and end-all of our research effort.*"

He had written those words fifteen years earlier, in 2765, and delivered them as his first public address after his accession to the Archonate.

And, fifteen years later, a ship had gone to the stars and returned in less than a month.

Rising, McKenzie traversed the gleaming marble floor of his private chamber and passed through the irising sphincter into his transmat cubicle.

Naylor waited there, an obsequious little man in the stiff black robe of the Technarch's personal staff. "The coordinates are set, Excellency."

McKenzie stepped forward. The lambent green transmat field pulsed up from the floor aperture, forming a curtain dividing the cubicle in two. The hidden power generators of the transmat were linked directly to the main generator that spun endlessly on its poles somewhere beneath the Atlantic.

There was no sensation. The Technarch McKenzie was destroyed, a stream of tagged wavicles was hurled halfway across a world, and the Technarch McKenzie was reconstituted. If the moment of destruction had been longer, the pain would have been unbearable. But the transmat field ripped the Technarch's body molecule from molecule in so tiny a fragment of a microsecond that his neural system could not possibly have relayed the pain; and the restoration to life came with equal speed Whole and undamaged, McKenzie stepped through the field and out, almost instantly later, in the transmat cubicle at Central Australia spaceport.

It had been shortly before noon in New York. Here, it was early the following morning. A wallclock read 0213 hours. McKenzie left the transmat cubicle.

They spotted him at once; the Technarch's toweringly commanding figure was a familiar sight here, and they came running to greet him. McKenzie smiled a Technarch's greeting at Daviot and Leeson, who had developed the warp-drive that powered the experimental ship; at Herbig, the spaceport commandant; at Jesperson, the coordinator of faster-than-light research.

McKenzie said, "What's the news from the ship?"

Jesperson grinned boyishly. "They sent the all-okay signal five minutes ago. They're in a deceleration orbit, coming down on rocket drive, and they'll make touchdown at 0233 hours."

"How about their trip?"

Leeson said in his rumbling basso, "It seems they made it out and back."

"We don't know that for sure," Daviot objected.

McKenzie scowled. "Make up your minds."

Daviot said, "All we know is that they quote switched from warp-drive to plasma-drive some time last evening near the orbit of Jupiter, unquote."

The Technarch looked up and out. The clear desert air, utterly transparent, yielded a magnificent view of the heavens. Stars speckled the black sky like jewels.

In twenty minutes—nineteen—eighteen—the XV-ftl would be returning.

He looked at the stars. Hundreds, thousands of them. Every star within a radius of four hundred light-years that bore a habitable planet—and that was most of them—had been reached by humanity. For centuries now, ships traveling at nine-tenths of the speed of light had coursed outward to the stars, prisoned by the limiting velocity but still capable of eating up the parsecs, given enough time. It had taken six years to make the first one-way trip to the Centauri system. The return, via transmat, was all but instantaneous.

But you had to reach the stars before you could plant the transmat pickup there, and that was the stumbling-block. Ever outward, by little hops, the empire of Man expanded. But always hampered by the inexorable mathematical limits of the known universe. Once a planet could be reached and linked into the interstellar transmat network, it was as close to Earth as any other point within the network. The transmat gave infinite connectivity—once the link had been established. But until then—

So progress had been slow. After better than four centuries of interstellar travel, mankind had colonized every habitable world within a sphere of four hundred light-years' radius. And no other intelligent life-form had ever been discovered. The universe belonged to man—but it would be millennia before man could take possession.

That fact had irked McKenzie during his years of training for the Archonate, and when the death of Technarch Bengstrom raised McKenzie to the dais he bent all of Earth's energies to the task of cheating the chains of relativity.

There were failures, expensive ones. Test ships had been sent out and monitored and followed by manned ships, and the manned ships had exploded or never returned. And still there were volunteers for the next ship, and the next, and the one after that.

Until the Daviot-Leeson Drive, with its incredibly slender generator smashing a hole in space-time by controlled thermo-nuclear thrusts — and suddenly the way seemed clear. Space in the region of a star, reasoned Daviot and Leeson, is warped and distorted by the star's mass and heat. If only the same effect could be duplicated in miniature, if only a wedge could be opened in the space-time fabric wide enough for a ship to slip through, travel a predetermined course, and return—then man's dominion would be boundless.

It took six years from the first pilot models to the confidence that allowed McKenzie to send a manned ship to the stars. And now that ship was returning. In thirteen minutes, twelve, eleven. Jesperson, wearing headphones, was in contact with the main monitoring station at the far end of the field.

At five minutes before touchdown time Jesperson said, "They've sighted it clear and sharp."

McKenzie moistened his lips, turning away so the others would not see a hint of tension on the Technarch's face. Four minutes. Three. Two.

Jesperson was relaying the final countdown. And then the *XV-ft1* was there, arching down in a golden stream of flame, coming to rest in front of them, lowering its landing-jacks and stabilizers. The decontamination crew was swabbing down the field; the hatch was opening. Men came forth.

Technarch McKenzie counted them. One, two, three, four, five. No casualties, then.

The Technarch said to Jesperson, "Have the men brought up here right away."

"Hearkening, Excellency." Jesperson gabbled into a phone. Moments later, the door irised open and the crew of the *XV-ft1 entered.*

They looked tired, sallow-faced, sweaty. The beards belonged to Laurance, Peterszoon, and Clive. Nakamura's face was clean-shaven, but his black hair hung dankly over his ears. Only Hernandez looked completely well-groomed. But all five men had the same weary, overstrung look.

McKenzie walked briskly toward them. His big hand seized Laurance's limp, moist one.

"Welcome back, Commander. All of you, welcome."

"Obedience, Excellency. It's—good to be back."

"It was a successful trip?"

An expression of doubt crept into Laurance's bloodshot, red-rimmed eyes. "Successful? Well, I suppose. The drive worked beautifully. We covered ninety-eight hundred light-years in the snap of a finger. But—"

Daviot whooped jubilantly. Leeson slapped Jesperson on the back. McKenzie said crisply, "But *what?*"

Laurance looked around. "It's—it's kind of classified, Technarch McKenzie. Maybe we'd better wait till later—"

"You can speak in the presence of these men."

"All right. We had a smooth trip. We ducked in and out of hyperspace and came out just where we wanted to be, and we got back home the same way. Only we met some aliens out there."

"You met *aliens?*"

"Not really *met.* We *saw* them, and got the deuce away from there before they saw us. They were building a city, Excellency. It looked like—like they were colonizing that planet, just like we would do."

CHAPTER 2

FOUR hours later the entire Archonate convened. The thirteen men who ruled Earth and her network of dependent worlds foregathered in the Long Room, on the hundred-and-ninth story of the Center building.

They had come from every part of the world, summoned from their individual duties by McKenzie's call, arraying themselves in their traditional places along the rectangular table. In the center sat the Geoarch, old Ronholm, nominal first among the thirteen equals who comprised the Archonate. To Ronholm's right sat the Technarch McKenzie. At the Geoarch's left was Wissiner, Archon of Communications. At Wissiner's side of the table were Nelson, Archon of Education; Heimrich, Archon of Agriculture; Vornik, Archon of Health; Lestrade, Archon of Security; Dawson, Archon of Finance. To the right of McKenzie sat Klaus, Archon of Defense; Chang, Archon of the Colonies; Santelli, Archon of Transportation; Minck, Archon of Housing; Croy, Archon of Power.

As the Archon of technology, science, research, McKenzie was the most important man in the room. But he observed protocol scrupulously. He permitted Geoarch Ronholm the first word.

"We have been called together, the old man quavered, "to hear of matters the Technarch considers of prime importance to the future welfare of our worlds. I relinquish the chair to the Archon of Technological Development."

McKenzie spoke without rising. "Members of the Archonate, four hours ago a spaceship landed in Australia after completing a journey of nearly ten thousand light-years in less than a month—and of that month, better than three weeks were spent in exploration. The actual interstellar trip was virtually instantaneous. That would normally be occasion for great rejoicing; for now, the stars lie within the reach of us all, within our lifetimes. But there is a complicating factor. I call now on Dr. John Laurance, Commander of the *XV-ftl* which returned a short while ago, to explain the nature of this factor to us all."

McKenzie gestured, and Laurance rose, a thin, tall figure, in the center of the room

Laurance came forward until he was within twenty feet of the Archons. He was a man of forty, with close-cropped hair just turning a grizzled gray, and a lean, bony face which just now reflected the many tensions of his recent trip.

He said, "Excellencies, I was chosen by you to command the first manned Daviot-Leeson interstellar ship. I left Earth on the First of Fivemonth past, with my crew of four. Travelling at a constant velocity of interplanetary rate, we reached the orbit of Pluto, the assigned safety zone, and converted to the Daviot-Leeson drive there.

"We left the 'normal' universe at a distance of some forty astronomical units from the Earth and followed our precalculated course for seventeen hours, until reaching our intended position. Making use of the Daviot-Leeson drive once again, we returned to the 'normal' universe and found that we had indeed reached our goal, the star NGCR 185143 at a mean distance of approximately ninety-eight hundred light-years from Earth.

"This star is a G-type main sequence sun with eleven planets. Following our instructions, we made landing on the fourth of these planets, which was Earthtype to six places and thus suitable for colonization. To our great surprise, we found that a city was in the process of construction on this planet."

McKenzie said, "Tell us about the aliens you saw."

"Yes, Excellency. I dispatched my crewmen Hernandez and Clive to reconnoiter. They observed the aliens for several hours."

"What were these aliens like?" asked the Archon of Defense, Klaus, in his thin, testy voice.

"Humanoid, Excellencies. We have photographs of them which would have been available for display had we—had we been given sufficient notice to prepare them. They stand about two meters in height, are two-legged, oxygen-breathing, and in many respects are much like ourselves. Skin pigmentation is green, though some observed aliens were blue. They appear to have a more complex joint structure than we do; their arms are double-elbowed, permitting motion in all directions, and they seem to have seven or perhaps eight fingers. Opposable thumbs, of course. They wear clothing. In brief, they seem to be an intelligent and energetic race of about the same stage of evolutionary development as ourselves."

The Archon of Security asked quietly, "Are you certain you were not observed?"

"They paid no outward attention to our ship. At all times my men remained hidden while observing them."

"We're *not* alone, then," said Ronholm, half to himself. "Other beings out there, building their colonies too—"

"Yes," interrupted McKenzie crisply. "Building their colonies too. I submit that we've stumbled over the greatest threat to Earth in our entire history."

"Why do you say that?" asked Nelson, the Archon of Education. "Just because another species ten thousand light-years away is settling a few worlds, Technarch, you can't really draw dire conclusions."

"I can, and I am. Today the Terran sphere of worlds and the alien sphere are thousands of light-years apart. But we're expanding constantly, even forgetting the new spacedrive for the moment, and so are they. It's a collision course. Not a collision between spaceships, or planets, or even suns. It's an inevitable collision between two stellar empires, theirs and ours."

"Have you a proposal?" the Geoarch asked.

"I have," McKenzie said. "We'll have to contact these people at once. Not a hundred years from now, not next year, but next week. We'll have to show them that we're in the universe too—and that some kind of accord is going to have to be reached—*before* the collision comes!"

"How do you know," asked Security Archon Lestrade, "that these—aliens—have any hostile intent at all?"

"Intent of hostility is irrelevant. They exist, we exist. They colonize their area; we, ours. We're headed for a collision."

"Make your recommendation, Technarch McKenzie," the Geoarch said mildly.

McKenzie rose. "I recommend that the newly returned faster-than-light ship be sent out once again, this time carrying a staff of negotiators who will make contact with the aliens. The negotiators will attempt to discover the purposes of these beings and to arrive at a cooperative entente in which certain areas of the galaxy will be reserved for one or the other of the colonizing races."

"Who's going to pilot the ship this time?" asked the Archon of Communication.

McKenzie looked surprised. "Why, we have a trained crew with us today who have proved their capabilities."

"They've just returned from a month-long expedition," Archon Wissiner protested. "These men have relatives, families. You can't send them out again immediately!"

"Would it be better to risk our one completed faster-than-light ship by putting it in the hands of inexperienced men?" McKenzie asked. "If the Archonate approves, I will present before the end of the day a list of those men I think are suited for treating with the aliens. Once they have been assembled, the ship can leave at once. I leave the matter in your hands."

McKenzie returned to his seat. A brief, spiritless debate followed; although several of the Archons privately resented the sometimes high-handed methods of the Technarch, they rarely dared to block his will when it came to a vote. McKenzie had been proved right too often in the past for anyone to go against him now.

He sat quietly, listening to the discussion and taking part only when it was necessary to defend some point. His features reflected none of the bitterness that had welled up within him since the return of the *XV-ft1*. The homecoming had been ruined for him.

Aliens · building colonies, he thought bleakly The shiny toy that was the universe was thus permanently tarnished in the Technarch's mind. He had dreamed of a universe of waiting planets, through which mankind could spread like a swiftly-flowing river. But that was not to be. After hundreds of years, another species had been encountered. Equals? It seemed that way—if no worse. Whatever their capabilities, it meant that mankind now was limited, that some or perhaps all of the universe now was barred to them. And in that respect McKenzie himself felt diminished.

There was nothing to do but negotiate, to salvage some portion of infinity for the empire of Earth. McKenzie sighed.

The vote took place. Each Archon operated a concealed switch beneath his section of the table. To the right for support of the measure, to the left for opposition. Above the table, a gleaming globe registered the secret tally. White was the color of acceptance, black that of defeat. McKenzie was the first to throw his switch; a swirl of pure white danced in the mottled gray depths of the globe. An instant later a spear of black lanced through the white—and then another white, another black. Gray predominated, swirling inconclusively. The hue leaned now toward the white, now to the black. Sweat beaded the Technarch's forehead. The color grew light as votes were shifted.

At last the globe displayed the pure white of unanimity. The Geoarch said, "The proposal is approved. Technarch McKenzie will prepare plans for the negotiating mission and present them to us for our approval. This meeting is adjourned until reconvened by the Technarch."

Rising, McKenzie made his way down from the dais and toward the five spacemen.

"May we go now, Excellency?" Laurance asked, obviously keeping himself under tight leash.

"One moment. I'd like to have a word."

"Of course, Excellency."

"I didn't come over to apologize. But I want to say that I know you boys deserve a vacation, and I'm sorry you can't have one yet. Earth needs you to take that ship out. You're the best we have; that's why you have to go."

He eyed the five of them—Laurance, Peterszoon, Nakamura, Clive, Hernandez. Half-throttled anger smouldered in their eyes. They were defiant; they had every reason to be. But they could see beyond their own momentary rage.

Laurance said, in his slow, deliberate way, "We'll have a day or two, won't we?"

"At least that much," the Technarch said. "But as soon as the negotiators are gathered, you'll have to go. If it's worth anything to you—you'll have a Technarch's gratitude for going." It was as far as McKenzie could lower himself toward being an ordinary human being. The smile slowly left his face, and he nodded a stiff salute and turned away. Laurance and his men would go. Now to pick the negotiating team.

CHAPTER 3

DR. MARTIN BERNARD was at his ease, that evening, in his South Kensington flat just off the Cromwell Road. Outside his window drifted London's murky Sixmonth fog; but Martin Bernard took no notice of that. His windows were opaqued. Within the flat, all was cozy, warm, snug. As he liked it. Ancient music tinkled softly down from the overhead sonic screen: Bach, it was, a harpsichord piece.

Bernard lay sprawled in his vibrochair, cradling a volume of Yeats on his lap. A flask of rare brandy, twenty years old, imported from one of the Procyon worlds, was within reach. Bernard had his drink, his music, his poetry, his warmth. What better way, he asked himself, to relax after spending two hours trying to pound the essentials of sociometrics into the heads of an obtuse clump of sophomores?

Even as he relaxed, he felt a twinge of guilt at his comfort. Academic people were not generally thought of as sybarites. But he told himself that he *deserved* this comfort. He was the top man in his field. He had, besides, written a successful novel. His poems were highly esteemed and anthologized. He had struggled hard for his present acclaim; now, at forty-three, with the problem of money solved forever and the problem of his second marriage equally neatly disposed of, there was no reason why he should not spend his evenings in this luxurious solitude.

He leaned back, thumbing through Yeats. A wonderful poet, Bernard thought; perhaps the best of the Late Medievals.

That is no country for old men. The young
In one another's arms, birds in the trees
—Those dying generations—at their song,
The salmon-falls, the mackerel-crowded seas—

The phone chimed, shattering the flow. Bernard scowled and elbowed himself to a sitting position; putting down the book, he crossed to the phone cabinet and thumbed the go-ahead button. The screen brightened; but instead of a face, the image of the Technarch's coat-of-arms appeared.

An impersonal voice said, "Dr. Martin Bernard?"

"That's right."

"Technarch McKenzie wishes to speak to you. Are you alone?"

"Yes. I'm alone."

"Please apply unscrambler."

Bernard lowered the toggle at the side of the phone. A moment later the coat-of-arms gave way to the head and shoulders of the Technarch himself. Bernard stared levelly at the strong, blocky-featured face of McKenzie. He inclined his head respectfully and said, "Hearkening, Technarch."

"Good evening, Dr. Bernard. Something unusual has arisen. I think you can help me—help us all."

"If it's possible for me to serve, Technarch—"

"It is. We've sent an experimental faster-than-light ship out, Dr. Bernard. It reached a system ten thousand light-years away. Intelligent colony-building aliens were discovered. We have to negotiate a treaty with them. I want you to head the negotiating team."

The short, punchy sentences left Bernard dizzy. He followed the Technarch from one startling statement to the next; the final sentence landed with the impact of a blow.

"You want—me—to head the negotiating team?"

"You'll be accompanied by three other negotiators and a crew of five. Departure will be immediate. The transit time is negligible. The period of negotiation can be as brief as you can make it. You could be back on Earth in less than a month."

Bernard felt an instant of vertigo. All seemed swallowed up: the book of poetry, the brandy, the warmth, the snugness. Punctured in a moment by this transatlantic call.

He said in a hesitant voice, "Why—why am *I* picked for this assignment?"

"Because you're the best of your profession," replied the

(Cont. on page 75)

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ANNIVERSARY

By ISAAC ASIMOV

Twenty years later they were still marooned—this time in oblivion!

THE annual ritual was all set. It was the turn of Moore's house this year, of course, and Mrs. Moore and the children had resignedly gone to her mother's for the evening.

Warren Moore surveyed the room with a faint smile. Only Mark Brandon's enthusiasm kept it going at the first, but he himself had come to like this mild remembrance. It came with age, he supposed; twenty additional years of it. He had grown paunchy, thin-haired, soft-jowled, and—worst of all—sentimental.

So all the windows were polarized into complete darkness and the drapes were drawn. Only occasional stipples of wall were illuminated, thus celebrating the poor lighting and the terrible isolation of that day of wreckage long ago.

There were space-ship rations in sticks and tubes on the table and, of course, in the center an unopened bottle of sparkling green Jahra water, the potent brew that only the chemical activity of Martian fungi could supply.

Moore looked at his watch. Brandon would be here soon; he was never late for this occasion. The only thing that disturbed him was the memory of Brandon's voice on the tube: "Warren, I have a surprise for you this time. Wait and see. Wait and see."

Brendon, it always seemed to Moore, aged little. The younger man had kept his slimness, and the intensity with which he greeted all in life, to the verge of his fortieth birthday. He retained the ability to be in high excitement over the good and in deep despair over the bad. His hair was going gray, but except for that, when Brandon walked up and down, talking rapidly at the top of his voice about anything at all, Moore didn't even have to close his eyes to see the panicked youngster on the wreck of the *Silver Queen*.

The door-signal sounded and Moore kicked the release without turning round. "Come, Mark."

It was a strange voice that answered, though; softly, tentatively, "Mr. Moore?"

Moore turned quickly. Brandon was there, to be sure, but only in the background, grinning with excitement. Someone else was standing before him; short, squat, quite bald, nut-brown and with the feel of space about him.

Moore said wonderingly, "Mike Shea— *Mike Shea*, by all Space."

They pounded hands together, laughing.

Brandon said, "He got in touch with me through the office. He remembered I was with Atomic Products—"

"It's been *years*," said Moore. "Let's see, you were on Earth twelve years ago—"

"He's never been here on an anniversary," said Brandon. "How about that? He's retiring now. Getting out of space to a place he's buying in Arizona. He came to say, hello, before he left; stopped off at the city just for that, and I was sure he came for the anniversary. 'What anniversary?' says the old jerk."

Shea nodded, grinning, "He said you made a kind of celebration out of it every year."

"You bet," said Brandon, enthusiastically, "and this will be the first one with all three of us here, the first *real* anniversary. It's twenty years, Mike; twenty years since Warren scrambled over what was left of the wreck and brought us down to Vesta."

Shea looked about. "Space-ration, eh? That's old-home-week to me. And Jahra. Oh, sure, I remember . . . Twenty years. I never give it a thought and now, all of a sudden, it's yesterday. Remember when we got back to Earth finally?"

"Do I!" said Brandon. "The parades. The speeches. Warren was the only real hero of the occasion and we kept saying so, and they kept paying no attention. Remember?"

"Oh, well," said Moore. "We were the first three men ever to survive a spaceship crash. We were unusual and anything unusual is worth a celebration. These things are irrational."

"Hey," said Shea, "any of you remember the songs they wrote. That marching one? 'You can sing of routes through Space and the weary maddened pace of the—' "

Brandon joined in with his clear tenor and even Moore added his voice to the chorus so that the last line was loud enough to shake the drapes. "On the *wreck* of the *Silver* Que-e-en," they roared out and ended laughing wildly.

Brandon said, "Let's open the Jabra for the first little sip. This one bottle has to last all of us all night."

Moore said, "Mark insists on complete authenticity. I'm surprised he doesn't expect me to climb out the window and human-fly my way around the building."

"Well, now, that's an idea," said Brandon.

"Remember the last toast we made?" Shea held his empty glass before him and intoned. 'Gentlemen, I give you the year's supply of good old H_2O *we used to have'* Three drunken bums when we landed. —Well, we were kids. I was thirty and I thought I was old. And now," his voice was suddenly wistful, "they've retired me."

"Drink!" said Brandon. "Today you're thirty again, and we remember the day on the *Silver Queen* even if no one else does. Dirty, fickle public."

Moore laughed. "What do you expect? A national holiday every year with space-ration and Jabra the ritual food and drink."

"Listen, we're still the only men ever to survive a spaceship crash and now look at us. We're in oblivion."

"It's pretty good oblivion. We had a good time to begin with and the publicity gave us a healthy boost up the ladder. We are doing well, Mark. And so would Mike Shea he if he hadn't wanted to return to space."

Shea grinned and shrugged his shoulder. "That's where I like to be. I'm not sorry, either. What with the insurance compensation I got, I have a nice piece of cash now to retire on."

Brandon said reminiscently, "The wreck set back Trans-space Insurance a real packet. Just the same, there's still something missing. You say *'Silver Queen'* to anyone these days, and he can only think of Quentin, if he can think of anyone."

"Who?" said Shea.

"Quentin. Dr. Horace Quentin. He was one of the non-survivors on the ship. You say to anyone, What about the three men who survived? and they'll just stare at you. 'Huh,' they'll say."

Moore said, calmly, "Come, Mark, face it. Dr. Quentin was one of the world's great scientists and we three are just three of the world's nothings."

"We survived. We're still the only men on record to survive."

"So? Look, John Hester was on the ship, and he was an important scientist, too; not in Quentin's league, but important. As a matter of fact, I was next to him at the last dinner before the rock hit us. Well, just because Quentin died in the same wreck, Hester's death was drowned out. No one ever remembers Hester died on the *Silver Queen*. They only remember Quentin. We may be forgotten, too, but at least we're alive."

"I tell you what," said Brandon, after a period of silence during which Moore's rationale had obviously failed to take. "We're marooned again. Twenty years ago today, we were marooned off Vesta. Today, we're marooned in oblivion. Now here are the three of us back together again at last, and what happened before can happen again. Twenty years ago, Warren pulled us down to Vesta. Now let's solve this new problem."

"Wipe out the oblivion, you mean?" said Moore. "Make ourselves famous?"

"Sure. Why not? Do you know of any better way of celebrating a twentieth anniversary?"

"No, but I'd be interested to know where you expect to start. I don't think people remember the *Silver Queen* at all, except for Quentin, so you'll have to think of some way of bringing the wreck back to mind. That's just to begin with."

Shea stirred uneasily and a thoughtful expression crossed his blunt countenance. "Some people remember the *Silver Queen*. The insurance company does, and you know that's a funny thing, now that you bring up the matter. I was on Vesta about ten-eleven years ago, and I asked if the piece of the wreck we brought down was still there and they said sure, who would cart it away? So I thought I'd take a look at it and shot over by reaction motor strapped to my back. With Vestan gravity, you know, a reaction motor is all you need. —Anyway, I didn't get to see it except from a distance. It was circled off by force-field."

Brandon's eyebrows went sky-high. "Our *Silver Queen?* for what reason?"

"I went back and asked how come they didn't tell me and they said they didn't know I was going there. They said it belonged to the insurance company."

Moore nodded, "Surely. They took over when they paid off. I signed a release, giving up my salvage rights when I accepted the compensation check. You did too, I'm sure."

Brandon said, "But why the force-field? Why all the privacy?"

"I don't know."

"The wreck isn't worth anything even as scrap metal. It would cost too much to transport it."

Shea said, "That's right. Funny thing, though; they were bringing pieces back from space. There was a pile of it there. I could see it and it looked like just junk, twisted pieces of frame, you know. I asked about it and they said ships were always landing and unloading more scrap, and the insurance company had a standard price for any piece of the *Silver Queen* brought back, so ships in the neighborhood of Vesta were always looking. Then, on my last voyage in, I went to see the *Silver Queen* again and that pile was a lot bigger.

"You mean they're still looking?" Brandon's eyes glittered.

"I don't know. Maybe they've stopped, but the pile was bigger than it was ten-eleven years ago so they were still looking then."

Brandon leaned back in his chair and crossed his legs. "Well, now, that's very queer. A hard-headed insurance company is spending all kinds of money, sweeping space near Vesta trying to find pieces of a twenty-year-old wreck."

"Maybe they're trying to prove sabotage," said Moore.

"After twenty years? They won't get their money back even if they do. It's a dead issue."

"They may have quit looking years ago."

Brandon stood up with decision. "Let's ask. There's something funny here and I'm just Jabrified enough and anniversaried enough to want to find out."

"Sure," said Shea, "but ask who?"

"Ask Multivac," said Brandon.

Shea's eyes opened wide. "Multivac! Say, Mr. Moore, do you have a Multivac outlet here?"

"Yes."

"I've never seen one, and I've always wanted to."

"It's nothing to look at, Mike. It just looks like a typewriter. Don't confuse a Multivac outlet with Multivac itself. I don't know anyone who's seen Multivac."

Moore smiled at the thought.

He doubted if ever in his life he would meet any of the handful of technicians that spent most of their working days in a hidden spot in the bowels of Earth tending a mile-long super-computer that was the repository of all the facts known to man; that guided man's economy; directed his scientific research; helped make his political decisions;—and had millions of circuits left over to answer individual questions that did not violate the ethics of privacy.

Brandon said as they moved up the power-ramp to the second floor, "I've been thinking of installing a Multivac, Jr. outlet for the kids. Homework and things, you know. And yet I don't want to make it just a fancy and expensive crutch for them. How do you work it, Warren?"

Moore said, tersely, "They show me the questions first. If I don't pass them, Multivac does not see them."

The Multivac outlet was indeed a simple typewriter arrangement and little more.

Moore set up the co-ordinates that opened his portion of the planet-wide network of circuits and said, "Now listen. For the record, I'm against this and I'm only going along because it's the anniversary and because I'm just jackass enough to be curious. Now how ought I to phrase the question?"

Brandon said, "Just ask: Are pieces of the wreck of the *Silver Queen* still being searched for in the neighborhood of Vesta by Trans-space Insurance? It only requires a simple yes or no."

Moore shrugged and tapped it out, while Shea watched with awe.

The spaceman said, "How does it answer? Does it talk?"

Moore laughed gently, "Oh, no. I don't spend *that* kind of money. This model just prints the answer on a slip of tape that comes out that slot."

A short strip of tape did come out as he spoke. Moore removed it and after a glance, said, "Well, Multivac says yes."

"Hah!" cried Brandon. "Told you. Now ask why?"

"Now that's silly. A question like that would be obviously against privacy. You'll just get a yellow state-your-reason."

"Ask and find out. They have not made the search for the pieces secret. Maybe they're not making the reason secret."

Moore shrugged. He tapped out: Why is Trans-space Insurance conducting its *Silver Queen* search-project to which reference was made in the previous question?

A yellow slip clicked out almost at once: *State Your Reason For Requiring The Information Requested.*

"All right," said Brandon, unabashed. "You tell it we're the three survivors and have a right to know. Go ahead. Tell it."

Moore tapped that out in unemotional phrasing and another yellow slip was pushed out at them: *Your Reason Is Insufficient. No Answer Can Be Given.*

Brandon said, "I don't see they have a right to keep that secret."

"That's up to Multivac," said Moore. "It judges the reasons given it and if it decides the ethics of privacy is against answering, that's it. The government itself couldn't break those ethics without a court order, and the courts don't go against Multivac once in ten years. So what are you going to do?"

Brandon jumped to his feet and began the rapid walk up and down the room that was so characteristic of him. "All right, then let's figure it out for ourselves. It's something important to justify all their trouble. We're agreed they're not trying to find evidence of sabotage, not after twenty years. But Trans-space must be looking for *something;* something so valuable that it's worth looking for all this time. Now what could be that valuable?"

"Mark, you're a dreamer," said Moore.

Brandon obviously didn't hear him. "It can't be jewels or money or securities There just couldn't be enough to pay them back for what the search has already cost them; not if the *Silver Queen* were pure gold. What would be more valuable?"

"You can't judge value, Mark," said Moore. "A letter might be worth a hundredth of a cent as waste-paper and yet make a difference of a hundred million dollars to a corporation, depending on what's in the letter."

Brandon nodded his head vigorously. "Right. Documents. Valuable papers. Now who would he most likely to have papers worth billions in his possession on that trip?"

"How could anyone possibly say?"

"How about Dr. Horace Quentin? How about that, Warren? He's the one people remember because he was so important. What about the papers he might have had with him; details of a new discovery, maybe. —Damn it, if I had only seen him on that trip. He might have told me something, just in casual conversation, you know Did *you* ever see him, Warren?"

"Not that I recall. Not to talk to. So casual conversation with me is out, too. Of course, I might have passed him at some time without knowing it."

"No, you wouldn't have," said Shea, suddenly thoughtful. "I think I remember something. There was one passenger who never left his cabin. The steward was talking about it. He wouldn't even come out for meals."

"And that was Quentin?" said Brandon, stopping his pacing and staring at the spaceman eagerly.

"It might have been, Mr. Brandon. It might have been him. I don't know that anyone *said* it was. I don't remember. But it must have been a big shot, because on a spaceship you don't fool around bringing meals to a man's cabin unless he *is* a big shot."

"And Quentin was *the* big shot on the trip," said Brandon, with satisfaction. "So he had something in his cabin. Something very important. Something he was concealing."

"He might just have been space-sick," said Moore, "except that—" He frowned and fell silent.

"Go ahead," said Brandon, urgently. "You remember something, too?"

"Maybe. I told you I was sitting next to Dr. Hester at the last dinner. He was saying something about hoping to meet Dr. Quentin on the trip and not having any luck."

"Sure," cried Brandon, "because Quentin wouldn't come out of his cabin."

"He didn't *say* that. We got to talking about Quentin, though. Now what was it he said?" Moore put his hands to his temples as though trying to squeeze out the memory of twenty years ago by main force. "I can't give you the exact words, of course, but it was something about Quentin being very theatrical or a slave of drama or something like that, and they were heading out to some scientific conference on Ganymede and Quentin wouldn't even announce the title of his paper."

"It all fits," Brandon resumed his rapid pacing "He had a new, great discovery, which he was keeping absolutely secret, because he was going to spring it on the Ganymede conference and get maximum drama out of it. He wouldn't come out of his cabin because he probably thought Hester would pump him —and Hester would, I'll bet. And then the ship hit the rock and Quentin was killed. Trans-space Insurance investigated, got rumors of this new discovery and figured that if they gained control of it, they could make back their losses and plenty more. So they took ownership of the ship and have been hunting for Quentin's papers among the pieces ever since."

Moore smiled, in absolute affection for the other man. "Mark, that's a beautiful theory. The whole evening is worth it, just watching you make something out of nothing."

"Oh, yeah. Something out of nothing? Let's ask Multivac again. I'll pay the bill for it this month."

"It's all right. Be my guest. If you don't mind, though, I'm going to bring up the bottle of Jabra. I want one more little shot to catch up with you."

"Me, too," said Shea.

Brandon took his seat at the typewriter. His fingers trembled with eagerness as he tapped out: What was the nature of Dr. Horace Quentin's final investigations?"

Moore had returned with the bottle and glasses, when the answer came back; on white paper this time. The answer was long and the print was fine, consisting for the most part of references to scientific papers in journals twenty years old.

Moore went over it. "I'm no physicist, but it looks to me as though he were interested in optics."

Brandon shook his head impatiently. "But all that is published. We want something he had not published yet."

"We'll never find out anything about that."

"The insurance company did"

"That's just your theory."

Brandon was kneading his chin with an unsteady hand. "Let me ask Multivac one more question."

He sat down again and tapped out: "Give me the name and tube number of the surviving colleagues of Dr. Horace Quentin from among those associated with him at the University on whose faculty he served."

"How do you know he was on a University faculty?" asked Moore.

"If not, Multivac will tell us."

A slip popped out. It contained only one name.

Moore said, "Are you planning to call the man?"

"I sure am," said Brandon. —Otis Fitzimmons, with a Detroit tube-number. Warren, may I—"

"Be my guest, Mark. It's still part of the game."

Brandon set up the combination on Moore's tube keyboard. A woman's voice answered. Brandon asked for Dr. Fitzimmons and there was a short wait.

Then a thin voice said, "Hello." It sounded old.

Brandon said, "Dr. Fitzimmons, I'm representing Trans-space Insurance in the matter of the late Dr. Horace Quentin—"

("For heaven's sake, Mark," whispered Moore, but Brandon held up a sharply restraining hand.)

There was a pause so long that a tube break-down began to seem possible and then the old voice said, "After all these years? Again?"

(Brandon snapped his fingers in an irrepressible gesture of triumph.)

But he said smoothly, almost glibly, "We're still trying to find out, doctor, if you have remembered further details about what Dr. Quentin might have had with him on that last trip that would pertain to his last unpublished discovery."

"Well—" There was an impatient clicking of the tongue. "I've told you, I don't know. I don't want to be bothered with this again. I don't know that there was *anything*. The man hinted, but he was always hinting about some gadget or other."

"What gadget, sir?"

"I tell you I don't know. He used a name once and I told you about that. I don't think it's significant."

"We don't have the name in our records, sir."

"Well, you should have. Uh, what was that name? An optikon, that's it."

"With a K?"

"C or k. I don't know or care. Now, please, I do not wish to be disturbed again about this. Good-bye." He was still mumbling querulously, when the line went dead.

Brandon was pleased.

Moore said, "Mark, that was the stupidest thing you could have done. Claiming a fraudulent identity on the tube is illegal. If he wants to make trouble for you—"

"Why should he? He's forgotten about it already. But don't you see, Warren? Trans-space has been asking him about this. He kept saying he'd explained all this before."

"All right. But you'd assumed that much. What else do you know?"

"We also know," said Brandon, "that Quentin's gadget was called an optikon."

"Fitzimmons didn't sound certain about that. And even so, since we already know he was specializing in optics toward the end, a name like 'optikon' does not push us any further forward."

"And Trans-space Insurance is looking either for the optikon or for papers concerning it. Maybe Quentin kept the details in his hat and just had a model of the instrument. After all, Shea said they were picking up metal objects. Right?"

"There was a bunch of metal junk in the pile," agreed Shea.

"They'd leave that in space if it were papers they were after. So that's what we want, an instrument that might be called an optikon."

"Even if all your theories were correct, Mark, and we're looking for an optikon, the search is absolutely hopeless now," said Moore, flatly. "I doubt that more than ten percent of the debris would remain in orbit about Vesta. Vesta's escape velocity is practically nothing. It was just a lucky thrust in a lucky direction and at a lucky velocity that put our section of the wreck in orbit. The rest is gone, scattered all over the Solar system in any conceivable orbit about the Sun."

"They've been picking up pieces," said Brandon.

"Yes, the ten percent that managed to make a Vestan orbit out of it. That's all."

Brandon wasn't giving up. He said thoughtfully, "Suppose it *were* there and they hadn't found it. Could someone have beat them to it?"

Mike Shea laughed. "We were right there, but we sure didn't walk off with anything but our skins, and glad to do that much. Who else?"

"That's right," agreed Moore, "and if anyone else picked it up, why are they keeping it a secret?"

"Maybe they don't know what it is."

"Then how do we go about—" Moore broke off and turned to Shea, "What did you say?"

Shea looked blank. "Who me?"

"Just now, about us being there." Moore's eyes narrowed. He shook his head as though to clear it, then whispered, "Great Galaxy!"

"What is it?" asked Brandon, tensely. "What's the matter, Warren?"

"I'm not sure. You're driving me mad with your theories; so mad, I'm beginning to take them seriously, I think. You know, we *did* take some things out of the wreck with us. I mean besides our clothes and what personal belongings we still had. Or at least I did."

"What?"

"It was when I was making my way across the outside of the wreckage—Space, I seem to be there now, I see it so clearly—I picked up some items and put them in the pocket of my spacesuit. I don't know why; I wasn't myself, really. I did it without thinking. And then, well, I held on to them. Souvenirs, I suppose. I brought them back to Earth."

"Where are they?"

"I don't know. We haven't stayed in one place, you know."

"You didn't throw them out, did you?"

"No, but things do get lost when you move."

"If you didn't throw them

out, they must be somewhere in this house."

"If they didn't get lost. I swear I don't recall seeing them in fifteen years."

"What were they?"

Warren Moore said, "One was a fountain-pen, as I recall; a real antique, the kind that used an ink-spray cartridge. What gets me, though, is that the other was a small field-glass, not more than about six inches long. You see what I mean? A field-glass?"

"An optikon," shouted Brandon. "Sure!"

"It's just a coincidence," said Moore, trying to remain level-headed. "Just a curious coincidence."

But Brandon wasn't having it. "A coincidence, nuts! Trans-space couldn't find the optikon on the wreck and they couldn't find it in space because you had it all along."

"You're crazy."

"Come on, we've got to find the thing now."

Moore blew out his breath. "Well, I'll look, if that's what you want, but I doubt that I'll find it. Okay, let's start with the storage level. That's the logical place."

Shea chuckled. "The logical place is usually the worst place to look." But they all headed for the power-ramp once more and the additional flight upward.

The storage level had a musty, unused odor to it. Moore turned on the precipitron. "I don't think we've precipitated the dust in two years. That shows you how often I'm up here. Now, let's see; if it's anywhere at all, it would be in with the bachelor collection; I mean the junk I've been hanging on to since bachelor days. We can start here."

Moore started leafing through the contents of plastic collapsibles while Brandon kept peering anxiously over his shoulder.

Moore said, "What do you know?- My college year-book. I was a sonist in those days; a real bug on it. In fact, I managed to get a voice recording with the picture of every senior in this book." He tapped its cover fondly. "You could swear there was nothing there but the usual trimensional photos, but each one has an imprisoned—"

He grew aware of Brandon's frown and said, "Okay, I'll keep looking."

He gave up on the collapsibles and opened a trunk of heavy, old-fashioned woodite. He separated the contents of the various compartments.

Brandon said, "Hey, is that it?"

He pointed to a small cylinder that rolled out on the floor with a small clunk.

Moore said, "I don't— Yes! That's the pen. There it is. And here's the field-glass. Neither one works, of course. They're both broken. At least I suppose the pen's broken. Something's loose and rattles in it. Hear? I wouldn't have the slightest idea as to how to fill it so I can check as to whether it really works. They haven't even made ink-spray cartridges in years."

Brandon held it under the light. "It has initials on it."

"Oh? I don't remember noticing any."

"It's pretty worn down. It looks like J K.Q."

"Q?"

"Right, and that's an unusual letter with which to start a last name. This pen might have belonged to Quentin; an heirloom he kept for luck or sentiment. It might have belonged to a great-grandfather in the days when they used pens like this; a great-grandfather called Jason Knight Quentin or Judah Kent Quentin or something like that. We can check the names of Quentin's ancestors through Multivac."

Moore nodded, "I think maybe we should. See, you've got me as crazy as you are."

"And if this is so, it proves you picked it up in Quentin's room; so you picked up the field-glass there, too."

"Now hold it. I don't remember that I picked them both up in the same place. I don't remember the scrounging over the outside of the wreck that well."

Brandon turned the small field-glass over and over under the light. "No initials here."

"Did you expect any?"

"I don't see anything in fact, except this narrow joining mark here." He ran his thumbnail into the fine groove that circled the glass near its thicker end. He tried to twist it unsuccessfully. "One piece." He put it to his eye. "This thing doesn't work."

"I told you it was broken. No lenses."

Shea broke in. "You've got to expect a little damage when a spaceship hits a good-sized meteor and goes to pieces."

"So even if this were it," said Moore, pessimistic again, "if this were the optikon, it would not do us any good."

He took the field-glass from Brandon and felt along the empty rims. "You can't even tell where the lenses belonged. There's no groove I can feel into which they might have been seated. It's as if there never—*Hey!*" He exploded the syllable violently.

"Hey what?" said Brandon.

"The name! The name of the thing!"

"Optikon, you mean?"

"Optikon, I don't mean! Fitzimmons, on the tube, called it an optikon and we thought he said 'an—optikon.' "

"Well, he did," said Brandon.

"Sure," said Shea. "I heard him."

"You just thought you heard him. He said, 'anoptikon.' —Don't you get it? Not 'an optikon,' two words, 'anoptikon,' one word."

"Oh," said Brandon, blankly. "And what's the difference."

"A hell of a difference. 'An optikon' would mean an instrument with lenses, but 'anoptikon,' one word, has the Greek prefix 'an-' which means 'no' Words of Greek derivation use it for 'no.' Anarchy means 'no government,' anemia means 'no blood,' anonymous means 'no name' and anoptikon means—"

"No lenses," cried Brandon.

"Right! Quentin must have been working on an optical device without lenses and this may be it and it may not be broken."

Shea said, "But you don't see anything when you look through it."

"It must be set to neutral," said Moore "There must be some way of adjusting it." Like Brandon, he placed it in both hands and tried to twist it about that circumscribing groove. He placed pressure on it, grunting.

"Don't break it," said Brandon.

"It's giving. Either it's supposed to be stiff or else its corroded shut." He stopped, looked at the instrument impatiently and put it to his eye again. He whirled, unpolarized a window and looked out at the lights of the city.

"I'll be dumped in Space," he breathed.

Brandon said, "What? What?"

Moore handed the instrument to Brandon wordlessly. Brandon put it to his eyes and cried out sharply. "It's a telescope."

Shea said at once, "Let me see."

They spent nearly an hour with it, converting it into a telescope with turns in one direction, a microscope with turns in the other.

"How does it work?" Brandon kept asking.

"I don't know," Moore kept saying. In the end, he said, "I'm sure it involves concentrated force-fields. We are turning against considerable field resistance. With larger instruments, power-adjustment will be required."

"It's a pretty cute trick," said Shea.

"It's more than that," said Moore. "I'll bet it represents a completely new turn in theoretical physics. It focuses light without lenses, and it can be adjusted to gather light over a wider and wider area without any change in focal length. I'll bet we could duplicate the five-hundred-inch Ceres telescope in one direction and an electron microscope in the other. What's more I don't see any chromatic aberration, so it must bend light of all wave-lengths equally. Maybe it bends radio waves and gamma rays also. Maybe it distorts gravity, if gravity is some kind of radiation. Maybe—"

"Worth money?" asked Shea, breaking in dryly.

"All kinds if someone can figure out how it works."

"Then we don't go to Trans-space Insurance with this. We go to a lawyer first. Did we sign these things away with our salvage rights or didn't we? You had them already in your possession before signing the paper. For that matter, is the paper any good if we didn't know what we were signing away? Maybe it might be considered fraud."

"As a matter of fact," said Moore, "with something like this, I don't know if any private company ought to own it. We ought to check with some Government agency. If there's money in it—"

But Brandon was pounding both fists on his knees. "To *hell* with the money, Warren. I mean I'll take any money that comes my way but that's not the important thing. We're going to be famous, man, famous! Imagine the story. A fabulous treasure lost in space. A giant corporation combing space for twenty years to find it and all the time we, the forgotten ones, have it in our possession. Then, on the twentieth anniversary of the original loss, we find it again. If this thing works; if anoptics becomes a great new scientific technique, they'll *never* forget us."

Moore grinned, then started laughing. "That's right. You did it, Mark. You did just what you set out to do You've rescued us from being marooned in oblivion."

"We all did it," said Brandon. "Mike Shea started us off with the necessary basic information. I worked out the theory, and you had the instrument."

"Okay. It's late, and the wife will be back soon, so let's get the ball rolling right away. Multivac will tell us which agency would be appropriate and who—"

"No, no," said Brandon. "Ritual first. The closing toast of the anniversary, please, and with the appropriate change. Won't you oblige, Warren?" He passed over the still half-full bottle of Jabra water.

Carefully, Moore filled each small glass precisely to the brim. "Gentlemen," he said solemnly, "a toast." The three raised the glasses in unison "Gentlemen, I give you the *Silver Queen* souvenirs, *we used to have.*"

THE END

On Sale in August AMAZING – June 25th

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A Choice Of Miracles

By JAMES A. COX

You're down in the jungle with death staring you in the face. There is nothing left but prayer. So you ask for your life. But wait! Are you sure that's really what you want above all else?

ANDY LARSON was a hard-headed Swede. He had to be, to be still alive. He hadn't been able to move anything but that hard head for what he estimated to be about three hours since he regained consciousness. And in that time he hadn't heard anything that led him to believe anyone else had survived the crash.

The only thing Andy Larson had heard was the water and the far-away whine of the patrol ship on its grid track search pattern. It had not reached his area yet, and he wasn't at all excited about his chances of being spotted when it did get nearer. He could turn his head, and he could see the tangled interlacing of tree branches and vines above and around him. He remembered, at the first moment of impact, just before the ship began to break apart, a tremendous geyser of mud and water. The picture was indelibly imprinted on his mind. He couldn't see the water now, but he could hear it. The litter he could see by twisting his head as far to the left as it would go told him they had crash-landed on the water—a river by the sound of it—and had skipped drunkenly, in something approximating flat stone fashion, into the forest lining the river's bank. There had been no explosion and no fire, there was no wide swath cut through the trees—and therefore no reason why he should assume the patrol would spot him. There might be pieces of the ship lying

Hurt and helpless, Larson waited for death.

where the patrol could see them. But he doubted that, for the river was deep and the vegetation was thick.

He strained his ears, not to hear if the patrol was approaching closer, but listening for the sound of life around him. This was his one hope—another survivor, and of necessity a mobile one. Someone to shout and wave, to climb a tree, to find an open space and build a fire, to light a flare, to do something—anything—that would attract the patrol's attention. Andy Larson wasn't afraid of dying. He felt no panic, no agonies of conscience, remorse or bitterness at the apparent inevitability of the prospect before him. But if he was not destined to die he needed a miracle or the assistance of that almost impossible—but only almost—survivor. And instead of praying for the miracle, he listened with all the hearing power at his command for the sound of human life. That would be miracle enough, and he didn't intend to stop listening until he couldn't any more.

Not that he didn't pray at all; back home in New Jersey, while not considered a pillar of the church, Andy Larson was known as a good, practicing Lutheran. But it was doubtful if the Lutherans, or any other sect for that matter, had sent missionaries this high into the heavens yet; the misbegotten flight he had been on had been only the fourth to reach this strange little planet of Abernathy since its discovery by the good professor back in '92. So Andy was no longer a practicing Lutheran, if practicing meant going to church. But he had prayed more than once during the long outward journey. And he was praying now, while his ears strained for sounds and his eyes strained for movement; praying for himself, yes, but even more for his wife, and for someone he had never seen.

He couldn't help being afraid for Elsie; he had been gone from home almost seven months, and she had been rocked with morning sickness for the last three weeks before he left, moaning over her saltines and begging him not to go even though she knew he couldn't and would not back out. She was afraid of the unknown he was going into, and he was afraid of the unknown that awaited her—it was the first time for both unknowns for both of them.

In a little while he could stop straining his eyes. Greenish dusk was slipping into night. Soon his ears would have to do all the work. The thought of night-prowling creatures disturbed him somewhat; no-one knew for sure yet what, if anything, lived in these thick, isolated jungles. Paralyzed as he was, he was fair game—his choice of words in the thought brought a grimacing smile to his face. He tried once again—was it the thousandth time yet?—to move his arms, his legs, his hands, a finger, a toe. Earlier, he had thought he was moving the big toe on his left foot, but he couldn't raise his head to see past the twisted bulk of metal that lay across him, the toe had nothing to rub upon to give it feeling, and there was absolutely no feeling between it and his head to give it any meaning anyhow. But it would have been a nice feeling just to know it was still there.

He gave up the attempt when sweat beaded out on his forehead and went back to listening and praying. He was tempted to pray for the miracle now, for blackness blotted out even the pitiful remains of the ship, and the whine of the patrol had muted to a singing hum in the distance.

The night turned cold and damp, but Andy Larson, in his sheathing of paralysis, didn't feel it. The loneliness was on him, the awesome loneliness of having to wait for death alone, with no warm hand to hold on to until the parting. He still felt no great fear or bitterness. Only the loneliness, and sadness. He would never know his son, or daughter, would never know that it loved him, that he was the biggest thing in its life. And it—that was ugly; he would call it "he"; if he had a choice a son it would be—he, his son, would never know his father, or how much his father wanted to love him. And Elsie—how lonely it would be for her. Her time must be getting close now, and she would be frightened. The doctor hadn't told her what he had told him—that she was too slight, definitely not built for childbearing. But she knew. And she would be brave, but frightened and alone.

The hours of night trudged by. The few stars that peeped through the trees were no help in telling the time, and Andy had lost interest in it anyhow. It was night, it had been night for what seemed like years, the blackness around him proclaimed it would be night still for many more years. He dozed off and on, at times waking with a start, thinking he had heard something. For a few minutes he would listen intently, feverishly. But when nothing reached his ears but the little night sounds he had become accustomed to, he would sink back into the lethargy that weighed upon his eyelids.

He wondered if he could be dying. He thought he was getting weaker—but how could he tell for sure? He could feel nothing, there was no pain, no muscular failure, no falling weakly to the ground. There were no muscles left and he was on the ground already. It was a Herculean effort to keep his eyes open, to listen as he had vowed he would. But that might be only fatigue, the need for sleep. And shock! Of course. He had to be suffering from shock, and from exposure, too. So if he didn't die of starvation, and if some beast didn't devour him, and if whatever wounds and injuries he had didn't do him in, he would probably die anyhow from pneumonia.

The thought was almost a comforting one. It took him off the hook, unburdened him of the need to worry about whether or not he lived. The thing was out of his hands, and no stubbornness on his part was going to do any good. He had prayed himself out before, prayed until the words of the prayers were nothing but imbecilic mutterings and mumblings, meaningless monosyllables swirling pointlessly and endlessly through his tired brain. The thing was out of his hands. He—Andy Larson—he gave up. He quit. He was nothing but a head that was hard and a body that was dead. What right did he have thinking he had any control over what happened to him? He was incapable of doing anything himself—he had to wait until something happened to him. And he knew what was going to happen. So that's what he'd do. He'd just wait.

He closed his eyes and saw Elsie, and before he realized he was going to do it he was praying again, talking to God about Elsie, and then talking to Elsie about God, and then back to God again and to Elsie again, and he knew he was crying because he could taste the tears, and he knew he was going to die because there wasn't anything else that could happen, and he knew suddenly that he was mortally afraid. He could not lay rigidly, tensely—there were no muscles to tighten. But the tension had to go somewhere. He felt a numbness creeping up the back of his neck, felt his eyes bulging as if they would burst, heard a roaring in his ears. He opened his mouth, gasping, trying to breathe deeply, the roaring in his ears reaching a crescendo and then breaking into a cold sighing wind that loudened and softened with the regularity of a pulse beat. He didn't know if he was awake or sleeping, dozing or dreaming, dying or dead. But he heard Elsie.

She was calling him. Over the cold black nothingness that separated them she was calling his name, her voice riding on the mournful wind sighing in his ears. He could hear her—it was as simple as that. He still didn't know if he was dreaming or dead. He didn't care. She was calling to him and he could hear, and although it wasn't the miracle he had wanted to pray for, still it was a miracle. He didn't question it; the comfort of hearing her voice after the terrible loneliness was enough. He didn't wonder how it could happen, didn't doubt that she could hear him answering her, as he was doing now. At first, so overcome with joy and relief, so thankful for the miracle, he didn't even recognize the tones of pain in her voice.

"Elsie, Elsie, Elsie," he cried out with his mind, reaching for her, wanting to seize her and hold her and never let her slip away again. "I hear you, my darling. I hear you!"

"Thank God!" Her voice broke, and the sound of sobbing carried on the wind reached his ears. For a moment it puzzled him. He had been crying, but his sobs were something different. The night suddenly seemed to turn much colder. "What is it, Elsie?" he called in fright.

The sobbing became a choking cough. He heard her grunt and gasp, and then a small scream turned his blood into ice. After a long moment she spoke again, panting, her voice strained and scratchy. "Thank God you can hear me, Andy. I've called and called. I prayed that I didn't care what happened, just so long as you could be with me. And you are, you are. It's a miracle and I don't know how. But you're with me and I won't be afraid any more. I won't . . . oh . . . oh . . ."

Andy suddenly understood. "Elsie," he cried frantically. "Where are you? Are you in the hospital? Is everything all right? Is the doctor there? *Elsie!*" He shouted her name aloud, angrily, trying to force it through the immense absorbent space between them, cursing and screaming at his own helplessness.

"Be quiet, Andy," she said at last. "Stop carrying on so. I'm all right now—it's just that the pain comes and sometimes I don't know what to do."

"But are you all right? Did the doctor—?"

"Shhh, Andy. Of course I'm all right. I'm in the labor room and there are lots of nice people to take care of me. Dr. Bell says it's like this often with first babies. And since I'm smaller than I should be—that doesn't help any. But I'm going to be all right."

"You called me, though. You said you were afraid of something, and prayed that—"

"You know how big a sissy I can be sometimes, Andy. Remember the time the wasp got in the bathroom while I was taking a shower, and how we got tangled up in the shower curtain where I was trying to hide from him and you were trying to catch him? And remember what happened right after that? Right there in the bathroom?" She laughed lightly.

To hear her laugh again! Andy smiled to himself, remembering. She had been so soft and cool and pretty, snarled in the shower curtain, her hair damp and curly, her cheeks flushed, uttering little squeals and yelps and giggles that were exciting music, and suddenly he wasn't chasing the wasp any more and she wasn't giggling because the wasp was tickling her. She had pulled his head under the shower, and he had got soaked anyway, so he climbed into the tub and she helped pull off his clothes and they soaped each other into a lather and they rinsed and they climbed out together, but they never got dried off and they never got out of the bathroom—at least not for a long time. And oh, how her laugh had tinkled then, and how he loved her when she laughed.

He thought of her laughing now, and a pain shot through his head. He tried to visualize her now, as she laughed—the swollen, hurt-looking belly, the heavy breasts dragging her frail shoulders forward, the drawn, pinched look he knew must be between her eyes as it was always when she felt unwell. He could visualize her this way, but not laughing. Then he heard her, and she wasn't laughing any more, and her moans were needles and her screams were knives.

It lasted longer this time. It lasted so long he could taste the blood where his teeth had ground through his lip, although he couldn't remember the pain of doing it. She came back to him at last, groaning weakly, and they talked, he cheerfully for her sake, she bravely for his. They remembered things they had done together, good times, happy times. They talked of what they would do when he came home, and what would they call the baby? Andy Junior if a boy? Elsie if a girl? Or Karen, or Mary, or Kirsten, or maybe Hermione? They laughed at that, and they laughed again at the thought of twins. But the laughs turned into gasps and cries of pain. And Elsie lay thrashing in the labor room of a hospital in New Jersey, and Andy lay rigidly under a rigidity not of his own making in a jungle far away.

She came back to him and told him the doctors had had a consultation, and had agreed to wait a little longer. She came back and told him they had decided they could not wait much longer, and would have to undertake a Caesarean. She came back and told him she had begged them to give her a little more time to try and do it herself, but she was afraid they were going to give her something to knock her out. She came and she went, but even when she was gone she was never so far away that Andy could not hear her. He wanted to stop his ears to the hysterical outpourings, but he was helpless, and he hated himself for wanting to.

When she came back the next time, with weakness turning her voice into a hoarse whisper, he begged her to take the drugs. But she wasn't listening to him. "Andy, Andy," she said, "listen to me please. It's important. They've decided on the Caesarean, and I haven't got much time. I've been thinking of the way we've been talking, and I think it happened because I needed you so much. That's how I got all the way to where you are. I needed you with me with every part of me, and somehow part of me found you. But Andy. you must have needed me, too. You must have needed me, Andy, or how did you get back to me?"

Despite the weakness of her voice, the fear in it rang out loudly. He tried to laugh and told her he was perfectly fine, except for worry about her. He made up a story about lying on his bunk, sipping a cool lemonade and listening to soft music, trying to calm his nerves over the prospect of becoming a new father and wondering where he would get the cigars to distribute to the boys.

But she wouldn't believe him. She insisted that he tell her the truth, pleading with him, crying out her love and her fear and her need. At last he told her of the crash, speaking lightly, pointing out that the patrol ship would be back with daylight and all would be well. He didn't mention the fact that he had no body below the neck, but he knew she knew it was worse than he described.

Then she was gone again, for so long a time he thought the operation had started. But the wind still blew raggedly in his ears, and she came back, slowly, but with new vibrancy in her voice. "Andy, you dope," she whispered with a brave attempt at sprightliness. "Why didn't you — tell — me — sooner?" She was gasping, but hurried on. "I can tell the doctor, and he can telephone somebody and they can use the radio and tell the patrol where you are. Oh! Andy—where are you—? Hurry—"

She was going again, and as quickly as he could he told her of the river and the jungle, and where approximately the ship had been just before the crash. Then she was gone and he closed his eyes and let the waves of near-hysterical relief wash over him. He was exhausted, the strain of long concentration had drained his strength, but he could almost feel the nerve ends in his dead body tingling with the exhilaration that sang in his mind. It was the miracle he hadn't dared pray for. It would be the greatest miracle ever performed, and he had almost lost it, almost killed it, almost thrown it away. But Elsie— He prayed feverishly now, thanking, thanking, and praying for the miracle to really happen and for Elsie and his son to be all right.

Then the wind was roaring blackly in his ears and the wind was turning into a shrieking demon and above it he could hear her wild scream: "They don't believe me! They say I'm delirious. Andy! They're coming with something to put me to sleep. They don't believe me, Andy . . ."

It ended. The wind stopped abruptly with her voice. The only things Andy Larson could hear were the blood pounding in his head and the grating of insects singing their last to the approaching dawn. It was all over, and he closed his eyes to the lightening sky. It was all over, the miracle was dead, the miracle never was, he was dead, he never was. Elsie— He rocked his head back and forth, wanting to cry, to curse and shout out his hatred of life. But nothing would come out, nothing was left.

It was all over. He lay under his memorial, a junk pile of twisted metal, inching his way toward death, the abortion of an abortive miracle, alone, tearless, wifeless, sonless, helpless.

A faint hum drifted to his ears. He looked up, wondering that the dawn had come so soon. The sky was brilliant with light, but still he could not see the patrol ship, knew that it couldn't see him, no matter how close the hum got.

The hum came closer and closer, grew louder, and then he heard her soft laugh and the hum faded away.

"Andy? Aren't you coming?"

He stared at the sky, his eyes bulging, his tongue swollen in his throat. He couldn't see anything, the light was so bright. He thought he must be dreaming—he had heard that people had strange visions when they were dying. But her voice sounded so real.

"Don't worry, honey," she said softly. "Everything is all right now. Come on, we're waiting."

He strained his eyes to see, and the phrase *we're waiting* struck him just as the other voice let out a cry.

"What—?" he mumbled, stupidly, happily, afraid to believe.

She laughed again, and little pieces of glittering silver tinkled through the gold of the sky. "I guess we'll have to call him Andy, after

(Cont. on page 51)

Editorial (cont. from page 4)

munications theory deals with the same problem—how to maximize the amount of information conveyed in a message without using a code so elaborate that the least mistake can cause the entire message to be misunderstood. An engineer would say that a competent poet uses codes of very low redundancy. So already I have some justification for the claim I am going to make later, that far from being alien to the traditional arts, science is one of their foundation stones.

But we haven't yet defined poetry. Rhyme and meter alone don't make it. If those were all that counted, Edgar Guest would be a poet and T. S. Eliot not. A. E. Housman, you recall, used this test. He would recite something mentally while shaving. If it made the whiskers stand up, it was poetry. I think that is about as good a criterion as any. So does Robert Graves.

However, it leads to some seeming paradoxes. A certain amount of what is called prose will do the same thing to us. Remember the scene in Conrad's *Heart of Darkness*, where the narrator sails past a warship shelling the African coast, though nothing of man is to be seen? "In the empty immensity of earth, sky, and water, there she was, incomprehensible, firing into a continent." There are enough other examples to show that no natural division exists between poetry and prose. We separate them arbitrarily, but any living process, such as literature is, will always spill over manmade frontiers.

And then there are mathematical theorems which have as much conciseness, beauty, and exaltation to offer as any poem. Of course, only mathematicians understand them. But then, not everybody understands Yeats or cummings, and this does not detract from the quality of their work. Pure mathematics has a highly developed esthetic sense. It is not considered enough simply to prove a theorem. The proof should be elegant, as mathematicians say—that is, have a cleanness of logic entirely analogous to the cleanness of a good style with words. Furthermore, the concepts of mathematics can be as emotionally meaningful as the concepts of poetry. Cantor's alephs, his orders of infinity where each is infinitely higher than the previous one, give the same sense of vastness and inhuman splendor as the Book of Job.

I seriously think that only tradition and convenience keep us from regarding mathematics and poetry as two facets of the same thing. But then, should we exclude science itself? Let us examine that case.

Certainly the findings and theorizings of science today are quite unbelievably wonderful. Consider a few astronomical data. Our sun is about 93 million miles away from us. Light takes eight minutes to get from there to here. But light takes more than four years to reach the next nearest star. One light-year is almost six trillion miles. This great Catherine's wheel of a galaxy in which we live is 100,000 light-years across. It is composed of something like a hundred billion stars. Though interstellar space is a harder vacuum than we have produced in the laboratory—it holds only about one atom per cubic centimeter—the galaxy is so big that there may be enough gas in this hollowness to equal the mass of all the stars.

Go out one winter night and look at Orion. In it there is a glowing nebula where the gas and dust are thicker, and where stars are forming · new suns being kindled as we sit here, with planets on which life will begin to stir half a billion years hence. Or look at Andromeda. With the naked eye you can see a dim cloudiness which the telescope reveals as another galaxy like our own, fiery nucleus and spiral arms. But the light by which you see it departed nearly two million years ago. The total number of galaxies within range of the Mount Palomar telescope is estimated at a million million. The thought of a universe so huge and strange and beautiful affects me as much as any poem.

Turning to the very small, we find the same intricate mystery. Not long ago I came upon a photograph—strictly speaking, an electron micrograph, but in any event a picture taken with a camera—of a molecule. The molecule was DNA, the material from which chromosomes are built up, the stuff of heredity and indeed of life itself. We have all seen other photographs, which resemble meteors and bursting stars; but what they show is the shattering of atoms and the phoenix-like birth of new structures that are still ill understood, still a challenge to our powers of comprehension.

IN my study I keep an object given me by a different kind of scientist. It is a chunk of yellow flint, chipped out in approximately the shape of a thick arrowhead, about a foot long, a so-called hand ax. It was not made by Homo Sapiens but by a Neanderthal man of the Acheulian period, perhaps 100,000 years ago. I often heft that ax and wonder what thoughts went through the oddly shaped brain of the being who made it. Or I look out the window to where a lizard sits under a rosemary bush and reflect how the lizard is my brother, compared to our eons-removed common ancestry with the bush—and still we are kin to the plants, as of three or four billion years ago when life began on Earth.

So it is certainly tempting to call science a kind of poetry. But we had better resist the temptation. After all, the language of science is not integral to it. You could rephrase a scientific report any way you chose, as long as you stayed accurate, and it would not affect the meaning. This is impossible with a poem or a mathematical demonstration. Science is more analogous to the visual arts than the verbal ones, and even that analogy is a little strained.

Nevertheless, science is a creative activity. Furthermore, it is the characteristic one of our era. The last really first-rank poets (in my opinion, anyhow) are now dead or very old; the last major painters and composers lie still further back in time. I don't feel especially apologetic about this. No epoch is good at everything. The future will regard with high respect the men who first mapped the galaxy and the chromosome: the same respect as we afford the Greeks who first experimented with democracy and carried sculpture as far as it has ever gone. The beauty of our scientific work will endure after the theories are superseded, just as the work of Newton in the eighteenth century and Maxwell in the nineteenth is still beautiful. In any event, whether we like it or not, the creative energy of man in the mid-twentieth century has gone almost entirely into science.

But why, then, is there not a scientifically conscious formal art? When the creative energy of the dying Roman Empire went into religion, it brought forth not only new modes of thought, but fresh and vital arts: especially a new literature in the West, a new architecture and mosaic in the East. Why is science not inspiring us in a similar fashion?

Perhaps it is producing its own visual art. It would be difficult, if not impossible, for the human hand to paint anything as lovely as a good astronomical photograph of the Veil Nebula in Cygnus. I do not propose to go into that question, though, but will simply ask why there is so little scientific poetry. Again, I use "poetry" in a broad sense, as synonymous with the very best literature regardless of format.

If C. P. Snow is right, part of the trouble lies in the alienation between his two cultures, the scientific and the humanistic. I think he exaggerates the gap. But to the extent that it exists, I am inclined to blame the humanists.

Of course, there are a great many abysmally ignorant engineers and cookbook scientists who can't even put a decent English sentence together. That's why we have to employ such numbers of tech writers. But all the true scientists I have ever met, men and women who are doing original, important work in their particular fields of discovery, have a broad humanistic education. They know perfectly well who Thucydides was and who Jouvenel is; they listen with understanding to Beethoven and jazz alike; they are intensely concerned with the problems man faces in this hour of nuclear and population explosions.

On the other hand, the typical professor of liberal arts—not every one by a long shot, but the typical one—has no idea who William Rowen Hamilton was or who Freeman Dyson is; couldn't fight his way out of a high school chemistry course, let alone some basic quantum theory; and worse, doesn't care, is downright proud of his ignorance. There is no excuse for that. A humanist should be interested in what humanity is doing, and appreciative of it. He need not be familiar with every technical detail, any more than you need to perform stress analyses to understand architecture. But there can be no understanding of anything without knowledge of its fundamental principles.

ONE cannot escape this duty by calling science "cold, inhuman, blind to the higher truths." It isn't, except to the extent that every discipline—including art—must necessarily leave most of the real world out of consideration. Furthermore, with due respect for the genius of the late William Faulkner, I wonder if exploring Mars may not prove a more important adventure, an adventure from which we will gain more comprehension of ourselves as well as our place in the universe, than exploring Southern degeneracy. I wonder if we may not learn more about the human condition from experiments with psychedelic drugs than from even the most exquisite secondary uses of corncobs.

Whether or not you agree with such polemics, you may admit that perhaps one reason for the lack of a scientifically oriented poetry is the refusal of most potential poets to have anything to do with science. They would rather retreat into their own little preciosities. And poetry isolated from life, from human activity, has always become a mere pastime for mandarins.

You might object that Freud, and psychoanalysis generally, has had an enormous effect on modern literature. This is true. I am not sure that the effect has been good, but let us not argue side issues. What I want to raise is a doubt that psychoanalysis is scientific. Freud himself, at least in his younger and less dogmatic days, regarded his theories as provisional—a stopgap until a true physical-chemical-biological picture of the mind could be built up. There is no satisfactory proof for the concepts of psychoanalysis. In fact, current experimental evidence seems to point in the other direction. Insanity, for example, is probably a set of organic diseases which claim their victims regardless of what Father said to Mother when anybody was six years old. The rate of cures claimed by analysis is no higher than the rate of spontaneous recovery. The fact that some people feel better after seeing an analyst proves nothing. Religion, Marxism, and stamp collecting have helped others just as much.

Before you get too outraged, I hasten to admit that psychoanalysis has given us some deep and valuable insights. My claim is merely that they are not scientific; they are akin to the insights of poetry. Psychoanalysis is not a science but an art.

With that parenthesis out of the way, let's see what literature actually has been based on the scientific enterprise.

Our first thought is of Jules Verne. Had he been a great writer, instead of simply a clever and sprightly one, he would be the perfect example of what I am getting at. His characters dealt with the technological realities of their period and revelled in the excitement of its burgeoning science. I think it no accident that Verne is still read, still influential, while many an intrinsically better writer—William Dean Howells, for instance—survives only in English departments. The respectable authors treated of matters which are now dead and gone. Verne reflected adventurous enthusiasm, which is as eternal as the agony of a Lear or the rapture of a Juliet.

H. G. WELLS had more gifts. His imaginative stories were only a small portion of his work, and not one that he himself regarded very highly. Yet, though his mundane novels are still worth reading, it is significant that he is remembered chiefly for his science fiction. Some of it comes close to poetry, like the grim and eerie scene at the end of the world, under the dying sun, in *The Time Machine*.

Rudyard Kipling was far too intelligent and alive to hold aloof from technology and science. He loved them. The spirit of the industrial age has nowhere been better expressed than in his long poem *McAndrews' Hymn*—

Lord, Thou hast made this world below the shadow of a dream,
An' taught by time, I tak' it so—exceptin' always Steam.
From coupler-flange to spindle-guide I see Thy Hand, O God—
Predestination in the stride o' you connectin'-rod.
John Calvin might ha' forged the same—enormous, certain, slow—
Ay, wrought it in the furnace-flame—my "Institutio."

I would also like to remind you of his ode *To the True Romance*, his superb futuristic stories *With the Night Mail* and *As Easy As A. B. C.*—and much else, a considerable percentage of his whole output. Kipling was one of the last true poets, and he was not ashamed to understand science and derive inspiration from it.

His Danish contemporary and admirer, Johannes V. Jensen, took the same attitude. Besides a number of popular scientific books, Jensen wrote an archeological novel, *The Long Journey*, which was a major reason for his receiving the Nobel Prize. In his historical *The Fall of the King* there is a stunning poem, nominally prose but absolutely a poem, in which the motifs of ancient Nordic myth blend with geology and astronomy to make one stupendous, delirious vision of cosmic dread.

Some of the better French novels early in this century were straight science fiction, by J. H. Rosny. His *La Guerre du Feu*, another archeological tale, is genuinely epic in scope and style. Of recent years, Vercors has further explored the possibilities of this genre.

Among Americans we have, of course, Sinclair Lewis' *Arrowsmith*, which is the story of a research scientist. Robinson Jeffers drew heavily on science for his philosophy and a great deal of his imagery. To a lesser extent, so did Robert Frost. We might also recall that the popular contemporary novelist Ernest Gann deals very capably with technological realities. I could go on citing examples, but they would get harder and harder to find and the number would never get large.

We are driven back to the question, "Why?" If science is an important motif which has been much neglected, and if this neglect is one reason for the decline in quality of "serious" literature, why have so few people done anything about it?

Well, there is one class of writers who have been trying, the science fiction authors. In many, if not all of their better works, science is integral to the plot and the motivations. I do not mean that the characters in a good science fiction story are, or should be, cold-blooded. Fiction is usually about people, and we want to explore the human psyche in sciance fiction just as much as we do in any other kind of writing. The point is that twentieth century man doesn't think like tenth century man, or even very much like nineteenth century man, and this change is going to continue in the future. Too many otherwise talented authors seem quite unconscious of that fact. But no competent writer of science fiction ever forgets it.

I DO not claim that science fiction is great literature. Hardly any of it is, and a lot is pretty awful. Nor do I claim that it is the literary form of tomorrow. I doubt that exceedingly. All I am trying to get across is that science fiction does have one virtue, one lesson to teach: its acceptance of science as a legitimate human activity; its attempts to re-examine the human condition in radically changed environments, under the light of radically new factual knowledge.

The best full-time science fiction writers are good by any standard: not in the same league as Shakespeare or Conrad, but more interesting and often more stirring than the average contemporary novelist. Probably the closest to a true poet within this field was the late Olaf Stapledon. The immensities of time and space with which he dealt, the skill with which he built up a sense of their reality, the tough-minded compassion with which he regarded all life everywhere, are to me deeply moving. I recommend to you, if you don't know them, his *Last and First Men*, which chronicles the entire future of the human race; its sequel *The Star Maker*, in which the story of *Last and First Men* is synopsized in a paragraph; and a small-scale, down-to-earth romance, *Sirius*, about a dog with human intelligence, this also has a lot to say about man.

Arthur Clarke sometimes writes in the mood of Stapledon—his novel *Childhood's End*, for instance—and sometimes in the more cool, conscious fashion that many science fiction authors favor. But the latter approach is not necessarily without esthetic values. Robert Heinlein once put into a story a description of what it feels like to study out a basic scientific problem. The writing is not immortal but the fact it relates is. "He enjoyed the controlled and cerebral ecstasy of the impersonal seeker for the elusive truth. The emotions felt in the throbbing thalamus were permitted only to form a sensuous obbligato for the cold flame of cortical activity. For the time being, he was sane, more nearly completely sane than most men ever achieve at any time." The story, by the way, appeared in September, 1940, and dealt with an atomic power plant.

John W. Campbell, now the editor of ANALOG, wrote a number of tales in his youth which reflected the sheer joy of technical accomplishment. But he also wrote in a poetic vein, for instance the unforgettable *Twilight*, a version of the human race dying gently, puzzled, wistful, among its too perfect machines which have left man no purpose whatsoever. Today Ray Bradbury is likewise a bit of a poet in his science fiction. His attitude toward the modern world seems primarily one of disgust, but he does realize that science and technology affect us in ways more profound than merely supplying the gadgets we use. Clifford Simak has written some fine, evocative stories, occasionally hinting at the utter strangeness of other planets, occasionally returning to his own Midwestern earth. Jack Vance paints the vivid, adventurous aspect of science and discovery with a gorgeous brush. What does it really feel like to be on an alien world, among hues and shapes never seen on Earth, under a red sun and three moons? Vance knows. Fritz Leiber has a comparable sense for the exotic and exciting.

THERE are others just as good, but I will only mention two who are unusual, in that they probe character more deeply than anyone else in the field. These are Theodore Sturgeon and Algis Budrys.

Sturgeon, a long-time practitioner of the art, is equally at home with a bulldozer, an electronic circuit, and a human mind. He has the poet's gift of the smiting, absolutely right phrase. That may be those paragraphs of brooding horror with which *It* opens; or the unspoken cry of a man to his love, as he falls into death, "Grace, Grace, treasure me in your cupped hands . . . ;" or simply a girl "tossing her searchlight hair back on her shoulders." In all such cases, and they are many, Sturgeon's words leap out of the page as they leap out of Homer. And in addition, he has an understanding of people, multiple kinds of people, which is always sympathetic but rarely too sentimental.

Budrys is younger; his style is clear and uncluttered, without going in for any very unusual word combinations; he would rather deal with the darknesses in us than the sunnier aspect which Sturgeon prefers—though he is not morbid. Most of his work has simply been better-than-average science fiction. However, his last three novels should have gotten wider attention than they did.

Who? starts out as a straightforward problem in identity. A man returns home, so mutilated in an accident that his face and most of his body had to be rebuilt in metal. Is he really the man he claims to be, or a spy planted by the Russians? Subtly, as the story progresses, the emphasis shifts. In the end, as Anthony Boucher has pointed out, you realize that the question never was the melodramatic "Who is he?" but the unanswerable "Who am I?" More recently Budrys has published a strange, difficult, but highly interesting book called *Rogue Moon*. On the surface it is about a lethal object encountered in the course of Lunar exploration; but there are numerous levels of meaning below that surface, and the symbolism is often effective enough to rank at least as minor poetry.

I HAVE dealt with these two at such length because I wanted to get specific about my claim, that in the living realities of science and technology there are unlimited resources for the modern writer and poet. Of course, it would be foolish to demand that everyone write science fiction, or odes to the Big Dipper, or any such obvious thing. I would like to see more of our leading writers do precisely that. But it is far from essential to a literary renaissance. What is essential, I think, is that they incorporate into their works a comprehension of what men today are discovering and creating in the actual world. The effort will reward them with broad new vistas.

Allow me a personal example, to show how even a writer like me, who has no special pretensions, can use these concepts. Not long ago I published a mystery, *Murder Bound*—not science fiction, but a fairly standard detective story, set principally along the San Francisco waterfront. At one point the hero is going aboard a docked ship; later he is on that ship as it puts out to sea. In both cases I wanted an atmosphere of uncanniness, a feeling that anything might happen at any moment but whatever it was would be sinister. In both cases, therefore, I simply gave a paragraph to reflect on a few facts of oceanography: the size, the age, and the inhumanness of the sea, epitomized by half a dozen scientific data but cast in language that reflected his awe and loneliness.

Anybow, that was my intention. Quite possibly the attempt fell flat on its face. That's for the readers to judge. But whether I pulled it off or not, I do claim that the idea itself was good, and that the body of modern knowledge is loaded with such ideas for anyone who cares to use them. This world today is not the drab treadmill populated with self-pitying neurotics that you read about in the fashionable novels. Anything but that! I agree it is a terrifying place. The fountains of the great deep are being broken up. But never have man's horizons been wider or his hopes higher. With all its savagery, the twentieth century is well worth living in.

I frankly believe that the spirit of our age finds one of its noblest expressions in the scientific enterprise, and that writers and poets do wrong to ignore it. Science does not have to be our only source of inspiration. But it is one of the sources that we cannot fail to draw on if we wish to write true poetry—or anything else that we can hope the future will remember.

Sources of Quotations

Haiku by Matsuo Basho from Introduction to Haiku *by Harold G. Henderson, Doubleday Anchor Books. Copyright 1958 by Harold G. Henderson.*

Joseph Conrad, Heart of Darkness, *in* A Conrad Argosy, *Doubleday, Doran & Company, Inc. Copyright 1942 by Doubleday, Doran & Company, Inc.*

Rudyard Kipling, McAndrews' Hymn, *in* Rudyard Kipling's Verse, *Doubleday and Company, Inc. Copyright 1939 by Caroline Kipling.*

Robert Heinlein, Blowups Happen, *Astounding Science-Fiction, September 1940. Copyright 1940 by Street & Smith Publications, Inc.*

(cont from page 41

his father. He was a slowpoke too."

She was there beside him now—or he was beside her—he didn't know which, for he was suddenly free of the great weight that held him down, he had the sensation of floating lightly through the air. But they were together and she was radiant, and he was happier than he had ever thought he could be, even though she couldn't put her arms around him as he wanted her to because her arms were full of his son. His arms weren't full—only his eyes and his throat and his heart—and he put them around her, holding her tightly.

The baby howled a protest, and Elsie laughed her wonderful laugh again. "He has a good voice, Andy, don't you think?"

"A lovely voice," Andy agreed, and his own voice sounded to him as if he were singing.

THE END

DOLCE AL FINE

By JACK SHARKEY

Here is one of the most original "end-of-the-world" stories we've ever read, an incisive vignette that illumines the soul of man.

LADISLOS began to stir beneath the coarse, frozen matting of the fur quilt. Stiff and irregular, it barely served to keep his raggedly swathed body free of contact with the nightly snows, the snows that fell increasingly more softly, more thickly. The cold had long lost its power to make him shiver. Even trembling used up energy, and his body seemed to sense that it had to rely solely on whatever fuel it had been able to store up while there was still food.

He felt Johansen, curled near to him, twitch in his sleep, and then awaken. He heard the little whimperings as Johansen beat the dry white surfaces of his palms together, trying to pound into them more warmth than they'd been able to absorb from his body, even though he slept with arms crossed tightly, and fingers burrowing deep within his armpits.

"Ladislos?"

Johansen whispered the name as he always did, lately, as though fearful there would be no reply. Even the whisper was a bare suggestion of sound, so that in the event Johansen heard no response, he could convince himself that he hadn't really spoken loudly enough, convince himself that a louder effort would evoke an answer. And then, once he was convinced, he would not call again, for a second answering silence would tell Johansen that at last he, Eric Johansen, was the last man alive on Earth.

"Yes, Eric. I'm here. Your hands . . . Are they all right?"

A sigh seemed to escape between Eric Johansen's lips at the voice that sounded in his ears, and he didn't even answer the question. Ladislos could bear him still beating his palms, gone leathery with exposure and a terrible fishbelly white to look upon, and reasoned that when Eric's hands would finally move no more, Eric would tell him. Until that day, it was a waste of breath and energy to ask.

The fur quilt, which even covered their heads, was too rigid to lie flat where its outer edges should have been limply upon the ground. Ladislos could sense, without looking directly, the pallid blue light that lay everywhere beyond the borders of this, their only shelter against the eternal winter that gripped the planet. Today would be . . . how did that phrase go, back on that old TV program? . . . a day like any other day, but—? Something like that, Ladislos remembered. The day, Ladislos knew without trying to lift the quilt from them, would be stark and clear and cold. Everywhere he would look once he'd left his brittle fur shelter he would see nothing but an ugly jumble of whiteness extending from the west to the east. There had been a time when he was able to identify, not from sight but from memory, many of the humped shapes that arose about their camp, a solitary diversion in a world of blue ice and white crystalline snow. There had been a time when he knew the precise hummock that hid Elise's grave, the tiny swell that marked the unassailable stump of the last tree they'd cut down for their fire, sawed and hacked and broken almost flush with the surface of the soil itself.

Now, there was nothing but immediate sensation when he emerged from beneath the quilt. No memory to plague him with sorrow and longing that did a man no harm, but no good, either. Ladislos shook his head slowly, looking—had he been able to see himself in a glass—like some great wooly bear. His head was a blue-black tangle of long, almost cordlike hair, mixed and matted and locked in place by the steel grip of ice crystals. It had taken him much too long to come out from under the quilt, Ladislos thought, wearily. Nearly a minute, a full minute, to crawl out of his sleeping place and stand erect upon the endless plane of snow. It was too long.

He and Johansen slept longer and longer periods each day. There just *was* no more food to be had, and yet the omnipresence of falling snows saved them from death by thirst. That mercy was denied them. And the cold, most bitter at night, was by day never enough to drain all their energies away. It had something to do with the ice, Ladislos remembered, fuzzily. It had always seemed an inversion of what *should* be, in nature, that when water froze, it gave off heat. It was only when ice was *melting* that heat was sucked from the surrounding air

The glacier to the north was still a barely visible crest that followed the line of the blindingly white horizon, which stung his eyes painfully despite its being only the reflected light of a pale golden sun. To the south, the companion glacier hadn't as yet appeared to give their camp matching borders.

Perhaps, Ladislos thought dimly, we are further north than we'd thought when we came here. They'd hoped they were at the equator, when they first arrived at the campsite. It was impossible to be certain, with everything under its snow blanket. When the depth of the snows was measured not in inches, but in tens of feet, a Canadian Pine was hardly distinguishable from a Coconut Palm.

A hollow scraping sound behind him told Ladislos that Johansen was coming from beneath the fur. Layers of ice and frost and snow had nearly made the quilt unrecognizable as such. Like *papier-maché*, it had molded itself to their slumbering forms, and now held itself stiffly in that impressed shape, fitting the two of them much as a walnut shell fit over the nutmeat itself.

Ladislos did not turn to watch Johansen's struggle to come out from their sleeping place, which they shared to concentrate the feeble emanations of body warmth. Eric would be embarrassed to be seen moving so stiffly and clumsily, he who had once been very much the athlete, lithe of movement and healthy, strong. Also, there was no need to turn around. Who else but Eric could it be that Ladislos heard?

Another bear, perhaps? Such as the one from whom they'd made the quilt under which they slept? Ladislos, rather than following this thought into its normal reaction, an apprehensive turn to assure himself that such was not the case, merely found himself dwelling happily upon the incident of that erstwhile bear, and the many weeks—months, perhaps? It was hard to be certain—they had gorged themselves upon the rich, oily flesh of its carcass. Ladislos sighed, remembering those times. That was when they still had fire, and they had cooked the meat (rather recklessly, he felt, in retrospect) upon the sharpened spikes of green twigs, held out over the campfire. (We were fools, thought Ladislos, those twigs might have kept my Elise warm for one more day . . .)

One more day. And for what? To suffer that much longer? To know for another twenty-four hours that they were the last human beings upon the entire planet, that escape was impossible, that the last of the silvery starships had long since departed, crammed almost to the airlocks with the lucky remnants of a threatened humanity who had managed to claw their ways aboard before the blastoff? No, Ladislos thought, it were better that she die. And Eric, too. And himself.

"The gloves, Ladislos?" Eric's voice whispered huskily in his ear, not quite concealing a whine of sharp need.

"Yes, Eric, yes." Ladislos said hastily. He began to fumble with the rigid rawhide thongs that laced the thick "gloves" onto his hands, extending partially above the wrist. It was hard work, manipulating the ragged end of thong from where it was tucked under itself. A knot in the thong was out of the question; they'd never have been able to remove the frozen twist of thin leather from his arms, then.

Eric was still slapping one hand against the other, his short, stubby fingers a dull blue-white with the cold. Useless to ask Eric's help in unfastening the layers of wool and shreds of fur that made up the gloves. Eric's fingers were nearly incapable of motion when they arose each day, for almost an hour, sometimes.

Ladislos had ceased, many weeks ago, to feel guilty about wearing the only warm hand-coverings they had, while Eric's fingers gradually lost all their strength. At first, he'd insisted on alternating with Eric in their use, but Eric's miserable sobs, on that one morning when Ladislos's fingers had been unable to perform their functions, had helped him to harden his heart against this false pity.

"When we die, Ladislos," Eric had said, the salty tears frozen upon his blond-furred cheeks, "we must die as Men, not as animals. Your hands are all we have left to remind us of what Man once had, of what Man once was . . ."

Henceforth, Ladislos had worn the wrappings without complaint. And Eric had been happy, even though his own hands were useless as a statue's. The hands of Ladislos were the only hands about which Eric cared, anymore.

The thongs crisped and crackled as he slowly unwound them, being careful lest they should break. He shook the wrappings impatiently from his left hand as they loosened, and his hand, freed of the warm encumbrance, soon had the thong on the right hand removed.

Ladislos stooped and carefully picked up both wrappings and their thongs, and slipped them beneath the edge of the hardened fur quilt. There they would remain until the Ritual was over, and he and Eric returned once more to their cold bed upon the hard-packed snow.

"Can you help?" he asked Eric, shuffling away from the quilt. "I don't know if I can manage alone."

"I will try," said Eric, following him.

The day was clear and bright as they made their way across the snow to a tall mound, not quite so tall as themselves. Ladislos hardly noted the fact that a path had been worn in the snows between their sleeping place and the mound, though elsewhere the white powdery stuff had drifted hip-deep and undisturbed.

He reached the mound and began to dust the snows of the previous night from the resilient surface of the wide woolen blanket. He bent and took hold of the edge near the ground, and watched with a stab of pity as Eric tried vainly to grasp the corresponding edge at the far side with fingers grown useless as straw.

Eric, after a futile minute's labors, sat down in the snow and began to cry.

"Never mind, Eric," Ladislos said, soothingly. "I will manage."

Eric's sobs did not abate until Ladislos, after many trips from one side of the mound to the other, had managed to lift the stiffened blanket, a foot at a time on each side, clear of the squarish, brown structure underneath.

Ladisloa looked upon it and smiled, gently. It had taken a long time, a time without fire, for them to use even a part of this, their last link with the past. After one particularly agonizing night of icy sleet and stinging cold, they had compromised by unbolting the unnecessary upper lid and breaking it up for a campfire. Then, in succession, had come the upper front lid, and then the lower. Only the barest essentials now remained of it. The bench had gone, much earlier, after they'd been unable to cut any more trees.

Ladislos was thankful that, despite the hundreds of moving parts, it needed no lubrication. Oil would have frozen during the night, and rendered it useless, leaving it just another piece of kindling.

Eric had ceased crying, finally, and just sat upon the snow, like a hopeful child, waiting. Ladislos had to smile. Man *was* more than a mere animal, after all. Had they been bound strictly by the drives of their flesh, they would have long before used this object for its heat-value alone. But, Ladislos thought, gazing with a smile at the incredible blue of the dome of sky, his hair and whiskers, in their ice and snow sheaths, reflecting back the pale glory of the dying sun, Man was more than flesh and bone and blood. Man had hungers stronger than those of physical comforts, physical desires.

It was good, thought Ladislos. To die as a Man was a good thing. He was happier in this knowledge than he'd ever been before in his life.

"Ladislos . . ." said Eric, some of the old enthusiasm back in his weak voice, "*Please* begin! . . ."

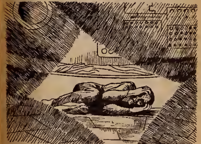
With a smile at his friend, Ladisloa, the last musician on Earth, leaned toward the last piano and began to play.

THE END

The space ships were miracles of power and precision; the men who manned them, rich in endurance and courage. Every detail had been checked and double checked; every detail except——

THE NOTHING EQUATION

By TOM GODWIN



THE cruiser vanished back into hyperspace and he was alone in the observation bubble, ten thousand light-years beyond the galaxy's outermost sun. He looked out the windows at the gigantic sea of emptiness around him and wondered again what the danger had been that had so terrified the men before him.

Of one thing he was already certain; he would find that nothing was waiting outside the bubble to kill him. The first bubble attendant had committed suicide and the second was a mindless maniac on the Earthbound cruiser but it must have been something inside the bubble that had caused it. Or else they had imagined it all.

He went across the small room, his magnetized soles loud on the thin metal floor in the bubble's silence. He sat down in the single chair, his weight very slight in the feeble artificial gravity, and reviewed the known facts.

The bubble was a project of Earth's Galactic Observation Bureau, positioned there to gather data from observations that could not be made from within the galaxy. Since metallic mass affected the hypersensitive instruments the bubble had been made as small and light as possible. It was for that reason that it could accommodate only one attendant.

The Bureau had selected Horne as the bubble's first attendant and the cruiser left him there for his six months period of duty. When it made its scheduled return with his replacement he was found dead from a tremendous overdose of sleeping pills. On the table was his daily-report log and his last entry, made three months before:

I haven't attended to the instruments for a long time because it hates us and doesn't want us here. It hates me the most of all and keeps trying to get into the bubble to kill me. I can hear it whenever I stop and listen and I know it won't be long. I'm afraid of it and I want to be asleep when it comes. But I'll have to make it soon because I have only twenty sleeping pills left and if—

The sentence was never finished. According to the temperature recording instruments in the bubble his body ceased radiating heat that same night.

The bubble was cleaned, fumigated, and inspected inside and out. No sign of any inimical entity or force could be found.

Silverman was Horne's replacement. When the cruiser returned six months later bringing him, Green, to be Silverman's replacement, Silverman was completely insane. He babbled about something that had been waiting outside the bubble to kill him but his nearest to a rational statement was to say once, when asked for the hundredth time what he had seen:

"Nothing—you can't really see it. But you feel it watching you and you hear it trying to get in to kill you. One time I bumped the wall and—for God's sake—take me away from it—take me back to Earth . . ."

Then he had tried to hide under the captain's desk and the ship's doctor had led him away.

The bubble was minutely examined again and the cruiser employed every detector device it possessed to search surrounding space for lightyears in all directions. Nothing was found.

When it was time for the new replacement to be transferred to the bubble he reported to Captain McDowell.

"Everything is ready, Green," McDowell said. "You are the next one." His shaggy gray eyebrows met in a scowl. "It would be better if they would let me select the replacement instead of them."

He flushed with a touch of resentment and said, "The Bureau found my intelligence and initiative of thought satisfactory."

"I know—the characteristics you don't need. What they ought to have is somebody like one of my engine room roustabouts, too ignorant to get scared and too dumb to go nuts. Then we could get a sane report six months from now instead of the ravings of a maniac."

"I suggest," he said stiffly, "that you reserve judgement until that time comes, sir."

And that was all he knew about the danger, real or imaginary, that had driven two men into insanity. He would have six months in which to find the answer. Six months minus— He looked at the chronometer and saw that twenty minutes had passed since he left the cruiser. Somehow, it seemed much longer . . .

He moved to light a cigarette and his metal soles scraped the floor with the same startling loudness he had noticed before. The bubble was as silent as a tomb.

It was not much larger than a tomb; a sphere eighteen feet in diameter, made of thin sheet steel and crisscrossed outside with narrow reinforcing girders to keep the internal air pressure from rupturing it. The floor under him was six feet up from the sphere's bottom and the space beneath held the air regenerator and waste converter units, the storage batteries and the food cabinets. The compartment in which he sat contained chair, table, a narrow cot, banks of dials, a remote-control panel for operating the instruments mounted outside the hull, a microfilm projector, and a pair of exerciser springs attached to one wall. That was all.

There was no means of communication since a hyperspace communicator would have affected the delicate instruments with its radiations but there was a small microfilm library to go with the projector so that he should be able to pass away the time pleasantly enough.

But it was not the fear of boredom that was behind the apprehension he could already feel touching at his mind. It had not been boredom that had turned Horne into a suicide and Silverman into—

Something cracked sharply behind him, like a gunshot in the stillness, and he leaped to his feet, whirling to face it.

It was only a metal reel of data tape that had dropped out of the spectrum analyzer into the storage tray.

His heart was thumping fast and his attempt to laugh at his nervousness sounded hollow and mirthless. *Something* inside or outside the bubble had driven two men insane with its threat and now that he was irrevocably exiled in the bubble, himself, he could no longer dismiss their fear as products of their imagination. Both of them had been rational, intelligent men, as carefully selected by the Observation Bureau as he had been.

He set in to search the bubble, overlooking nothing. When he crawled down into the lower compartment he hesitated then opened the longest blade of his knife before searching among the dark recesses down there. He found nothing, not even a speck of dust.

Back in his chair again he began to doubt his first conviction. Perhaps there really had been some kind of an invisible force or entity outside the bubble. Both Horne and Silverman had said that "it" had tried to get in to kill them.

They had been very definite about that part.

There were six windows around the bubble's walls, set there to enable the attendant to see all the outside-mounted instruments and dials. He went to them to look out, one by one, and from all of them he saw the same vast emptiness that surrounded him. The galaxy—his galaxy—was so far away that its stars were like dust. In the other directions the empty gulf was so wide that galaxies and clusters of galaxies were tiny, feeble specks of light shining across it.

All around him was a void so huge that galaxies were only specks in it. . . .

Who could know what forces or dangers might be waiting out there?

A light blinked, reminding him it was time to attend to his duties. The job required an hour and he was nervous and not yet hungry when he had finished. He went to the exerciser springs on the wall and performed a work-out that left him tired and sweating but which, at least, gave him a small appetite.

The day passed, and the next. He made another search of the bubble's interior with the same results as before. He felt almost sure, then, that there was nothing in the bubble with him. He established a routine of work, pastime and sleep that made the first week pass fairly comfortably but for the gnawing worry in his mind that something invisible was lurking just outside the windows.

Then one day he accidentally kicked the wall with his metal shoe tip.

It made a sound like that from kicking a tight-stretched section of tin and it seemed to him it gave a little from the impact, as tin would do. He realized for the first time how thin it was—how deadly, dangerously thin.

According to the specifications he had read it was only one-sixteenth of an inch thick. It was as thin as cardboard.

He sat down with pencil and paper and began calculating. The bubble had a surface area of 146,500 square inches and the internal air pressure was fourteen pounds to the square inch. Which meant that the thin metal skin contained a total pressure of 2,051,000 pounds.

Two million pounds.

The bubble in which he sat was a bomb, waiting to explode the instant any section of the thin metal weakened.

It was supposed to be an alloy so extremely strong that it had a high safety factor but he could not believe that any metal so thin could be so strong. It was all right for engineers sitting safely on Earth to speak of high safety factors but his life depended upon the fragile wall not cracking. It made a lot of difference.

The next day he thought

be felt the hook to which the exerciser spring was attached crack loose from where it was welded to the wall. He inspected the base of the hook closely and there seemed to be a fine, hairline fracture appearing around it.

He held his ear to it, listening for any sound of a leak. It was not leaking yet but it could commence doing so at any time. He looked out the windows at the illimitable void that was waiting to absorb his pitiful little supply of air and he thought of the days he had hauled and jerked at the springs with all his strength, not realizing the damage he was doing.

There was a sick feeling in his stomach for the rest of the day and he returned again and again to examine the hairline around the hook.

The next day he discovered an even more serious threat: the thin skin of the bubble had been spot-welded to the outside reinforcing girders.

Such welding often created hard, brittle spots that would soon crystallize from continued movement—and there was a slight temperature difference in the bubble between his working and sleeping hours that would daily produce a contraction and expansion of the skin. Especially when he used the little cooking burner.

He quit using the burner for any purpose and began a daily inspection of every square inch of the bubble's walls, marking with white chalk all the welding spots that appeared to be definitely weakened. Each day he found more to mark and soon the little white circles were scattered across the walls wherever he looked.

When he was not working at examining the walls he could feel the windows watching him, like staring eyes. Out of self defense he would have to go to them and stare back at the emptiness.

Space was alien; coldly, deadly, alien. He was a tiny spark of life in a hostile sea of Nothing and there was no one to help him. The Nothing outside was waiting day and night for the most infinitesimal leak or crack in the walls; the Nothing that had been waiting out there since time without beginning and would wait for time without end.

Sometimes he would touch his finger to the wall and think, *Death is out there, only one-sixteenth of an inch away.* His first fears became a black and terrible conviction: the bubble could not continue to resist the attack for long. It had already lasted longer than it should have. Two million pounds of pressure wanted out and all the sucking Nothing of intergalactic space wanted in. And only a thin skin of metal, rotten with brittle welding spots, stood between them.

It wanted in—the Nothing wanted in. He knew, then, that Horne and Silverman had not been insane. It wanted in and someday it would get in. When it did it would explode him and jerk out his guts and lungs. Not until that happened, not until the Nothing filled the bubble and enclosed his hideous, turned-inside-out body would it ever be content . . .

He had long since quit wearing the magnetized shoes, afraid the vibration of them would weaken the bubble still more. And he began noticing sections where the bubble did not seem to be perfectly concave, as though the rolling mill had pressed the metal too thin in places and it was swelling out like an over-inflated balloon.

He could not remember when he had last attended to the instruments. Nothing was important but the danger that surrounded him. He knew the danger was rapidly increasing because whenever he pressed his ear to the wall he could hear the almost inaudible tickings and vibrations as the bubble's skin contracted or expanded and the Nothing tapped and searched with its empty fingers for a flaw or crack that it could tear into a leak.

But the windows were far the worst, with the Nothing staring in at him day and night. There was no escape from it. He could feel it watching him, malignant and gloating, even when he hid his eyes in his hands.

The time came when he could stand it no longer. The cot had a blanket and he used that together with all his spare clothes to make a tent stretching from the table to the first instrument panel. When he crawled under it he found that the lower half of one window could still see him. He used the clothes he was wearing to finish the job and it was much better then, hiding there in the concealing darkness where the Nothing could not see him.

He did not mind going naked—the temperature regulators in the bubble never let it get too cold.

He had no conception of time from then on. He emerged only when necessary to bring more food into his tent. He could still hear the Nothing tapping and sucking in its ceaseless search for a flaw and he made such emergences as brief as possible, wishing that he did not have to come out at all. Maybe if he could hide in his tent for a long time and never make a sound it would get tired and go away . . .

Sometimes he thought of the cruiser and wished they would come for him but most of the time he thought of the thing that was outside, trying to get in to kill him. When the strain became too great he would draw himself up in the position he had once occupied in his mother's womb and pretend he had never left Earth. It was easier there.

But always, before very long, the bubble would tick or whisper and he would freeze in terror, thinking, *This time it's coming in . . .*

Then one day, suddenly, two men were peering under his tent at him.

One of them said, "My God —*again!*" and he wondered what he meant. But they were very nice to him and helped him put on his clothes. Later, in the cruiser, everything was hazy and they kept asking him what he was afraid of.

"What was it—what did you find?"

He tried hard to think so he could explain it. "It was—it was Nothing."

"What were you and Horne and Silverman afraid of—what was it?" the voice demanded insistently.

"I told you," be said. "Nothing."

They stared at him and the haziness cleared a little as he saw they did not understand. He wanted them to believe him because what he told them was so very true.

"It wanted to kill us. Please —can't you believe me? It was waiting outside the bubble to kill us."

But they kept staring and he knew they didn't believe him. They didn't *want* to believe him . . .

Everything turned hazy again and he started to cry. He was glad when the doctor took his hand to lead him away . . .

The bubble was carefully inspected, inside and out, and nothing was found. When it was time for Green's replacement to be transferred to it Larkin reported to Captain McDowell.

"Everything is ready, Larkin," McDowell said. "You're the next one. I wish we knew what the danger is." He

(cont. on page 74

FACT

OPERATION LUNACY

By LESTER DEL REY

Here is a mercilessly pragmatic appraisal of the "merciful armaments" our laboratories are stockpiling, and a question to ponder about weapons and morality.

IT SEEMS probable that some day in the near future mankind may get rid of the only deterrent to major war ever developed and return to our normal routine of horror, loot, rapine and conquest. We've already stockpiled the potential for such atrocities under the name of "merciful" armaments and we're trying to develop others.

The deterrent to war, of course, is our supply—and our opponent's supply—of A-bombs, H-bombs and possibly Cobalt-bombs. So long as such things are in existence and there is a chance of missiles to deliver them, the military business of war is virtually impossible.

This isn't the civilian idea of the bombs, to be sure. The average civilian thinks of an H-bomb as the most powerful weapon ever developed. Nothing could be further from the truth, however. Nuclear bombs are almost worthless for warfare, and they have made the conduct of any military operation so dangerous and unpopular that it is temporarily totally impractical.

To a well-schooled military mind, the nuclear bomb has no place in the scheme of warfare. Wars are fought for several purposes. One is to gain territory, which is pointless when all the assets of the bomb-won land are destroyed and the salient points of the territory are too radioactive for occupation for generations. Another aim of war is the taking over of other peoples to increase one's own might as a world power, or to become the only power. This cannot be done by a destructive means so thorough that no organized population can remain. (Meantime, unfortunately, there is always the danger that some fool underling will somehow trigger such a holocaust.)

That's why some of our best military minds are working overtime on both sides of the ocean to find a mutually-agreeable means of disarming the bombs and disposing of their nuclear dynamite. Unless some deplorable accident happens in the near future, it's a pretty certain guess that they'll be able to rid the world of the chance of nuclear warfare.

And at the moment that earth's last A-bomb is scuttled, the last horrible threat great enough to prevent deliberate worldwide warfare will be gone.

THE CHANCES FOR WAR

HISTORY is full of weapons so horrible as to make war "impossible," such as gunpowder, gas and the tank. A "classic" story of science fiction thirty years ago used monstrous tanks, planes and poison gases to paint almost the same picture of the final war as those imagined as a result of the nuclear forces. But only a few people ever believed that such weapons would reach through the military ranks and hit *them*. (Only civilians or soldiers in civilian posts of power make war; military men merely *wage* it.) But science has been able to draw such a true and convincing sketch of the invisible demons of radiation that much of the civilian population now is too aware of the dangers to permit major war while such weapons remain as a threat. For the first time in history, war is impossible except by madness or accident.

So we'll get rid of the nuclear bombs. But we won't thus get rid of our chance to make war. We've already been farsighted enough—as have other countries—to develop weapons of other kinds but of equal horror. We've even bragged about how well we've succeeded in this. For the past ten years, countless magazine articles have appeared telling of our development of bacteriological or germ warfare and of horrendous nerve gases that can subdue whole nations overnight.

Recently, the Army announced that it had such a large and varied stock of effective nerve gases in its stockpile that it was halting production. When a military branch makes that decision, it means they have far more than enough!

Of course, whenever such weapons are mentioned, there is

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a cry that men are too moral to use them. We didn't use gas in World War II, after all, nor in Korea. We didn't use nuclear bombs in Korea, either. I suspect that most people are a little uncertain about everyone's being too moral to drop the H-bomb; after all, *we* dropped two A-bombs on civilian populations. But once some measure of nuclear disarmament has been reached, the "too moral" argument will be brought up about that, too.

The idea of mentioning the word "moral" in the same sentence with nerve gas is so appalling that even Satan must retch. There is no morality even thinkable when such weapons are developed. Calling them "merciful" weapons is precisely like referring to a "clean" bomb, which still releases Carbon-14 with far more lingering and deadly effects than Strontium-90, as our own Senate stated.

MORALITY AND WEAPONS

WE are, however, far too moral about using weapons which are of no military usefulness whatever.

Poison gas, of the World War I type, was a brutal and sometimes effective weapon. It might have been more effective had the airplane been able to drop it massively on civilians. But World War I was a typical war, where the defense for a long time was developed beyond the offensive powers. It was a static warfare in trenches. In the few cases where gas was used in troop movements, it later proved to be more damaging to the side using it than to the enemy. It remained too long, and ruined future operations.

By the time World War II came along, effective gas masks had been stockpiled so well that the use of gas was ridiculous. For the same effort in use, other weapons were far more effective. Bombs against factories and rail centers meant more than gassing civilians. So we didn't use gas, though Japan did in China, where conditions were different.

We'll probably always remain too moral to use bacterial warfare, also, but for an even better reason. There simply is no really useful form of germ in existence or which we have been able to mutate which will do enough damage to others without boomeranging on ourselves to make using it worthwhile.

Bacteria—or germs or even viruses—can be mutated into all kinds of variations, of course. This can be done by radiation, by changing environments, or by transplanting a bit of cell nucleus from one creature to another. (This substance, known as DNA, is the basic material out of which cell structure and heredity are shaped.)

Like most mutations, however, only a certain number prove sufficiently viable and useful. Some lose the power to metabolize food. Others fail to divide into new cells. All kinds of things happen. Some do fine in the laboratory and die on human skin or in fresh water. Sunlight is lethal to many; others require an atmosphere free of oxygen.

Of those that manage to survive, most aren't aggressive enough. Either the cell must look on man (or some foodstuff of man's) as a host, or it must create a poison he can't tolerate. It must also spread so readily that it will attack most of the population.

Well, such germs have been developed—or viruses with similar powers. And lo and behold, they turn out to be pretty much standard diseases, already known, such as a variant of influenza. Nature has been mutating such cells over and over again day in and day out, during the long years of mankind's development. And out of the countless possibilities, the strongest and most dangerous have been the ones obviously most likely to succeed. If the disease is viable enough to make it suitable for an attack on man, it has probably been in business attacking man for a million years!

But somehow, without sanitation or antibiotics, man managed to survive. Most of the population lived through the bubonic plague and survived cholera during the ignorance of medieval times. Even syphilis, apparently imported from America to Europe, failed to ruin the race; in time, the disease seemed to grow tired and far more mild than it had been at first—which meant man built up a resistance to it.

THE LAST IMMUNITY

THOSE without resistance to such bugs died off somewhere between one million BC and now; those who survived passed on their resistance, from father to son. And man has one final line of defense against even some new variation—or one which has vanished for a few generations, but now remutates, such as some influenza.

Man's blood can perform a delicate chemical analysis on the invading posions and create antibodies. These new cells or substances act much like little caps on threaded pipe; they're tailored to mate the "screw" pattern of the dangerous molecule and plug it up with a totally useless end. Often, the body passes this immunity to future generations.

Nothing could have been much more fiendish than the influenza following the first War. It created havoc. But had it occurred in a country in danger of invasion, the havoc would have been fitted into place without seriously jeopardizing the fighting ability of our nation.

The favorite product mentioned for germ warfare is the poison which is responsible for botulism. But the organism producing this highly deadly poison simply isn't able to cope with the normal environment in large enough quantity to serve as a weapon. Nor is the poison itself so stable that it would not be possible to treat water in ways to destroy it without too much difficulty.

Civilians get very moral about using a weapon which serves no purpose. Military men are less self-deceptive; they simply decide its use is not expedient, except when writing press releases. Also, when a weapon has been worked on for twenty years, with countless stories in the papers and with perhaps some propaganda value as a terror inspiration among other nations, no military man is going to be so foolish as to proclaim his failure to make it work. There will be no announcement saying germ warfare is impossible. It just won't become expedient!

On the other hand, morality never seems to stand in the way of using any weapon which has a tactical—rather than a terror—advantage. Flame throwers are pretty grim and ugly weapons when turned on a man. We used them. Against a city of paper and bamboo like Tokyo, incendiary bombs are horrendous. We dropped them on the only raid we had sense enough to make during the early part of the war with Japan. For that matter, we dropped two of the nuclear horror weapons on that same Japan, without making too great an effort to pick a military target. We dropped the bombs because we would not accept Japan's surrender on condition she retain Hirohito as emperor; then we finally accepted surrender on just such a condition, though calling it unconditional.

In all fairness, however, it should be pointed out that dropping the bomb was a civilian decision. Perhaps the two billion dollars spent developing the weapon needed justification to a civilian Congress. But that doesn't matter, since most great military decisions today are directed ultimately by civilians.

Nerve gas is an entirely different matter. We have it, without any doubt. We've got immense amounts of it, we know it works, and we have excellent facilities for its use. Or rather, we've got them, since there are many different forms of nerve gases, with many different effects.

NERVE GAS FACTS

THESE are not properly gases at all, in the true meaning of the term. They're aerosol mists, like the vapor that comes out of a pressure can of bug spray. In fact, we might say that the first effective nerve gas was an aerosol mist of DDT, since that acted on the nerves of many forms of insects. Any good military man watching the use of a bug bomb must have dreamed of something like it to use against human enemies. From wish to fact was a fairly short step.

The advantage of the aerosol mist over a true gas is a very great one. In the first place, almost any finely pulverized solid can be suspended in such a mist, as can any liquid which will spray out in fine enough a form. The action of spraying it out by means of a pressurized volatile substance such as the freons then leaves the particles suspended like dust motes in the air, where they may remain for days or weeks.

Just as an example of how simple such a weapon could be, you might imagine suspending ragweed pollen and spraying it in a concentration greater than any occurring naturally! Of course, this wouldn't be a good weapon, since it only attacks a small percentage of the population; but for the susceptible, it would be totally incapacitating.

The first of such "gas" substances actually developed was almost as crude. It was a substance which acted by paralyzing the victim. A number of journals published the details on this, since it was not kept secret; an antidote that could be carried around by everyone was quickly discovered, making this gas almost useless.

That gas of a decade ago was what might have been called a merciful weapon It was reasonably painless—aside from the fear and horror as a man realized he was being hit by it. It could knock out a population without killing too many, provided medical care was given within a reasonable time. If the antidote hadn't been so easily guessed, it might have become an excellent weapon.

But after that, science reached back into the unknown to come up with pure black magic, in all its ugliest manifestations. From here on, the story stops reading like science fiction and reads like the nightmares of a wizard at the Sabbat! The source of the new knowledge was as unlikely as a true wizard would have been, since the discovery was made by psychiatrists.

Decades ago, Freud had made one of his rare contributions of true insight when he suggested that insanity might have a chemical basis in the body. Now suddenly, a chemical was found which could produce the symptoms of schizophrenia. This was lysergic acid, as reported in the papers. The volunteers who took it developed the symptoms of true temporary insanity. The use of a chemical could induce a psychotic state directly! Other drugs also turned out to have the power, such as serotonin. How many different drugs have been found is largely secret, but they produce all types of equally horrendous reactions.

Here was the substance for a perfect weapon.

*

By definition, the perfect weapon shouldn't kill. A corpse is far less trouble to the enemy than even a wounded man. A man who has gone insane would be better than a normal casualty, since he would foul up the actions of many others. A perfect weapon should also do no damage to enemy harbors, forts, weapons, plants, etc. It should wipe out all effective resistance, but it should destroy nothing of value to the conquerors. Ideally, it should so dishearten the enemy that they would accept conquest and never consider the possibility of resistance after their recovery.

THE ARCANE IDEAL

HERE in the insanity-producing (or nerve attacking) substances there was the potential of just such a weapon. Military men had speculated on it for years, and considered its requirements so mutually contradictory that it was impossible. Now, out of almost arcane dabblings into men's minds had come the ideal instrument!

The rest is clouded in bits of secrecy. Nobody is going to say precisely what has been done, or what chemicals are used. But the psychologists and psychiatrists who had a hand in creating it couldn't be kept out of things entirely, and they needed some of the stuff to study what drives men mad and how to treat insanity without the doubtful and slow art of analysis. The propagandists have also been given tiny bits of the results obtained, just to keep the other side worried.

One series of pictures was proof enough. The first few frames showed a cat in a cage. A mouse was introduced. The cat moved with beautiful precision, speared the mouse, and proceeded about proper feline business. The next sequence was after—quite a while after—the cat had received a mild gas treatment. Again the cat is in the cage, looking confused. Enter mouse. Cat promptly backs into the furthest corner of the cage, arching its back, baring its teeth and looking like the cat who discovered the world's largest and meanest dog. Eventually the mouse gets used to things and wanders toward the cat. Thereupon, the cat leaps frantically for another corner and goes into convulsions from fear!

This is a series of pictures widely released, and probably represents one of the minor achievements in designing nerve gases!

We were hardly too moral to develop such a gas, it seems. Oh, of course the military branches aren't supposed to be moral—they simply execute the final failure of diplomacy, as the saying goes about war. But I seem to recall that the civilian papers were delighted at our development. And none of the citizens to whom I pointed out the pictures expressed anything but admiration for our cleverness. Good old moral us were now ready to use this stuff to put an end to the immoralities of bad old them!

Merely paralyzing a whole population from planes spraying aerosol mist or U-2's dropping light aerosol bombs might not be more immoral than most war, I admit. I don't quite see how we could move in fast enough with rescue squads to revive most of the victims before they died, but that's still within the modern theories of warfare on the population at large.

But now let's be more realistic. We have gas which will not directly kill anyone, but will simply render the population insane. That is obviously merciful, isn't it? We don't kill anybody at all and yet we win the war. That is, we do provided they don't have missiles loaded with their gas bombs waiting for instant retaliation.

TARGET: YOU

ALL RIGHT. Imagine you're a citizen of Urbis Dohre. It's a normal day. Then there's perhaps a warning, before planes show up. But fear is replaced by curiosity as the planes spray out something like the vapor used in skywriting and then head away. You breathe a gasp of relief—and your mind begins to *twist* . . . they're all against you . . . You're *awful* . . . Maybe you sink to the ground in a catatonic fit. Beyond you, the nice old man from the grocery store goes back for his biggest knife. He has just been inspired by a Divine Message; he must kill all the evil people of this town to purify them. The knife flashes back and forth as he moves down the street smiling beatifically.

The maid in the apartment house has become a hebephrenic. She chants a singsong rhyme about her mother, turning on the gas. After a time, the odor reminds her of the idea she had. She strikes a match and waits for the big pretty flame.

The manic depressive at the local air base heads for the high test fuel tanks. He knows it's all his fault for everything, and nothing good can ever happen again. He'll have to let out enough gasoline to make a big enough flare so the planes can see him and recognize it's all his fault. Of course, with his luck, that will touch off the stockpile of explosives stored in the big shed and kill the whole base, but what can be do? Nothing ever goes right.

Over the hill, the vacationing general suddenly recalls that he is Napoleon's reincarnation. He must act—act first—immediately. Those missiles under his command must take off at once. Too bad he has no nuclear explosives, but maybe that nerve gas stuff will knock America out. "Now, Boris, don't question my orders! Get that stuff on the way. Of course I'll sign an authorization." Sure, Boris will follow orders. He'd better. No more Waterloos this time!

It would be a picture multiplied by millions of times in any modern country. Fires and auto collisions would desolate the cities and kill even the innocently insane. Murder, torture and berserk sadism would flourish. But it would hardly be fair to accuse anyone of being guilty among the gassed crowds. Surely, if there were such a thing as world law, the men who ordered the gas dropped would have to share all guilt with the men who elected them! It probably wouldn't occur to them, however. An atrocity is what the other side commits on your citizens.

Do the war crimes rules apply to such actions? Apparently, the war crimes precedent would apply, but only to the side that loses. If the attackers won, there would be no trials, but only decorations.

WAR-MADE ZOMBIES

THERE are accounts of an even nicer gas—one which simply paralyzes the will. The man then will act only when some outside order is given. He may not even eat without being told to do so, or until driven by extreme hunger. Once his hunger is sated, he relapses again. Anything told him is true, any order by anyone is valid, like the *geas* of an ancient magician.

We've had stories of that already, shown in the horror movies. Such things were supposed to occur only in the back country of Haiti. The victims were known as zombies, the living dead. And even Haiti has severe laws against the practice of creating a zombi.

Such creatures would not even procreate without accidental contact to arouse pure animal reflexes or orders from outside their own minds. But it hardly matters. As human beings—as a people—the pitiful things would already be dead.

There are laws against genocide. But again these laws apply only to the side which loses, or which is small enough to be called to account by other nations. Overruling this legal threat lies the fact that a will-destroying gas would be the ultimate weapon.

Having made it and threatened to use such a weapon, it's hard to believe morality would prevent our use of it in an emergency. And most people would hardly expect other nations to exercise more morality than we would.

So far, morality has never kept any powerful nation from making and using the strongest weapon possible. Only when one horror of a more efficient type has replaced an older horror is the obsolete method abandoned.

THE END

(cont. from page 64)

scowled. "I still think one of my roustabouts from the engine room might give us a sane report six months from now instead of the babblings we'll get from you."

He felt his face flush and he said stiffly, "I suggest, sir, that you not jump to conclusions until that time comes."

The cruiser vanished back into hyperspace and he was alone inside the observation bubble, ten thousand light years beyond the galaxy's outermost sun. He looked out the windows at the gigantic sea of emptiness around him and wondered again what the danger had been that had so terrified the men before him.

Of one thing he was already certain; he would find that nothing was waiting outside the bubble to kill him . .

THE END

ON SALE NOW IN JULY FANTASTIC

L. SPRAGUE DE CAMP & LIN CARTER'S NEW CONAN short novel, RED MOON OF ZEMBABWEI; also, THE STRONGHOLD by MARK S GESTON, TRACK TWO by BARRY N MALZBERG, AT BUG'S COMPLETE by DAVID R. BUNCH, and an outstanding short novel, THE KOZMIC KID by RICHARD SNEAD.

Technarch simply. "Can you free yourself of commitments for the next several weeks?"

"I—suppose so."

"I have your acceptance, then, Dr. Bernard?"

"I—yes, Excellency. I accept."

"Your service will not go unrewarded. Report to Archonate Center as soon as is convenient, Doctor—and no later than tomorrow evening New York time. You have my deepest gratitude, Dr. Bernard."

The screen went blank.

Bernard gaped at the contracting dot of light that had been the Technarch's face a moment before. He stared down suddenly at the floor, dizzy. *My God,* he thought. *What have I let myself in for? An interstellar expedition!*

Then he smiled ironically. The Technarch had just offered him a chance to be one of the first human beings to meet face-to-face with an intelligent nonterrestrial. And here he was, worrying about a temporary separation from his piddling little comfortable nest. *I ought to be celebrating,* he thought, *not worrying. Brandy and vibrochairs can wait. This is the most important thing I'll ever do in my life!*

He disconnected the sonic screen; the harpsichord music died away in the middle of a twanging cadence. Yeats returned to the bookshelf. He took a final sip of brandy and replaced the flask in the sideboard.

Packing was a problem; he winnowed out several fat books, packed two slim ones, some clothing, some memodiscs. He found himself unable to sleep, even after taking a relaxotab, and he rose near dawn to pace his flat in tense anticipation. At 1100 hours he decided to transmat across to New York, but his guidebook told him it would still be early in the morning on the other side of the Atlantic. He waited an hour, dialed ahead for courtesy permission to cross, and set his transmat for the Archonate Center.

Not many minutes later, he was in the private chambers of the Technarch McKenzie.

The Technarch was not in his chambers at the moment. But three other men were. One was a tall, dark-faced man with a gloomy scowl, dressed in the somber clothes that indicated his affiliation with the Neopuritan movement. Another was shorter, but still a little over six feet in height, a cheerfully affable-looking man in his early fifties. The third man was short and stocky, with quick, darting black eyes and heavy frown-lines in his forehead.

"Hello," Bernard said. "My name's Martin Bernard—I'm a sociologist. Are you three part of this outfit too?"

The affable-looking man put out his hand. "Roy Stone. Basically a politician, I guess. I'm understudy for the Archon of Colonial Affairs."

"And I'm Norman Dominici,"

the stocky one said. "Biophysicist, when I'm not out on expeditions to greenfaced aliens. Welcome to our little band."

Only the Neopuritan had not offered an introduction. Bernard turned uncertainly toward him. "Hello?"

"He isn't the friendly type," Dominici warned *sotto voce.*

The big man turned slowly. He was, Bernard thought, a hulking giant of a man—six-feet-six, at least, with the aloof, withdrawn look that men sometimes get when they grow to enormous heights at precocious ages.

"The name is Thomas Havig," the lanky Neopuritan said in a surprisingly thin voice. "I don't believe we've met before, Dr. Bernard—but we've shared the pages of several learned periodicals."

Bernard's eyes went wide. "Thomas Havig of *Columbia?*"

"Thomas Havig of Columbia. The Thomas Havig who wrote *Conjectures on Etruscan Morphemes*, Dr. Bernard. An article which you didn't seem to appreciate."

"Why—why, I simply couldn't swallow any of your premises. You flatly contradicted everything we know about the Etruscan personality and culture—"

"And therefore you took it upon yourself to attempt to destroy my reputation?" Havig asked maliciously.

"I merely wrote a dissenting opinion," shot back Bernard. "The *Journal* saw fit to print it. I—"

"Evidently you gentlemen are old friends, even though you've never met," commented Stone. "Or should I say old enemies?"

"We've had our disagreements professionally," Bernard admitted.

"You aren't going to carry those disagreements along for ten thousand light-years, are you?" Dominici asked.

Bernard smiled. "I suppose we can forget the Etruscans for this trip. Eh, Havig? Our quarrel was pretty small beer, after all."

He extended his hand. After a moment the towering Neopuritan grudgingly took it. The shake was brief; hands dropped quickly back to sides. Bernard moistened his lips. He and Havig had battled viciously over what was, indeed, a minor technical point. It was one of those quarrels that specialists often engage in when their separate specialties meet at a common point of junction.

"Well," said Roy Stone nervously, "we'll be leaving almost any minute now."

"The Technarch said we'd have at least until tonight," Bernard said.

"Yes. But we're all assembled, you see. And the ship and crew are ready as well. So there's no point in delaying any further."

"The Technarch wastes no time," Havig muttered darkly.

"There isn't much time to be wasted," Stone replied. "The quicker we get out there and deal with those aliens, the more certain we can be of preventing war between the two cultures."

The door irised open suddenly. Technarch McKenzie entered, a bulky, powerful figure in his formal robes. Technarchs were chosen for their size and bearing as well as for their qualities of mind. "Have you four managed to introduce yourselves to each other?" the Technarch asked.

"Yes, Excellency," Stone said.

"You'll be leaving in four hours from Central Australia. We'll use the transmat in the next room. Commander Laurance and his crew are already out there, giving the ship its final checkdown." The Technarch's eyes flicked meaningfully from Bernard to Havig, and back. "I've picked you four for your abilities, understand. I know some of you have had differences professionally. Forget them. Is that understood?"

Bernard nodded. Havig grunted assent.

"Good," the Technarch snapped. "I've appointed Dr. Bernard as nominal leader of the expedition. All that means is that final decisions will rest with him in case of absolute deadlock. If any of you object, speak up right now."

The Technarch looked at Havig. But no one objected.

McKenzie went on, "I don't need to tell you to cooperate with Commander Laurance and his crew in every way possible. They're fine men, but they've just had one grueling voyage, and now they're going right out again on another one. Don't grate on their nerves. It can cost you all your lives if one of them pushes the wrong button."

The Technarch paused as if expecting final questions. None came. Turning, he led the way to the adjoining transmat cubicle. Stone, Havig, and Dominici followed, with Bernard bringing up the rear.

We're an odd lot to be going starward, Bernard thought. *But the Technarch must know what he's doing. At least, I hope he does.*

CHAPTER 4

ONE thing mankind had forgotten how to do, in the peaceful years of expansion under the Archonate: it had forgotten how to *wait.* The transmat provided instantaneous transport and communication; from any point within Terra's sphere of dominion, any other point could be reached instantaneously. Such convenience does not breed a culture of patient men. Of all Terra's sons, only a special few knew how to wait. They were the spacemen who piloted the lonely plasma-drive ships, bearing with them the transmat generators that would make their destinations instantaneously accessible to their fellow men.

Someone had to make the trip by slow freight first. Spacemen knew how to wait out the empty hours, the endless circlings of the clock-bands. Not so others. They fidgeted the hours past.

The *XV-ft1* had left Earth at a three-g acceleration, hurling a fiery jet of stripped nuclei behind it until it had built up to a velocity of three-fourths that of light. The plasma drive was shut down, and the ship coasted onward. And its four passengers fretted in an agony of impatience.

Bernard stared without comprehending at the pages of his book. Havig paced. Dominici ground his teeth together and narrowed his forehead till his frowning brows met. Stone haunted the vision port, peering at the frosty brilliance of the stars. The four men were quartered together, in the rear compartment of the slender ship. Fore, Laurance and his four crewmen were stationed.

The hours dragged mercilessly. Some time later that day, when the four passengers were coming to their breaking-point, the door to their compartment opened and the crewman named Clive entered.

He was a small man, built on a slight scale, with a mocking, youthful face and unruly, strangely graying hair. He smiled and said, "We're passing across the orbit of Pluto. Commander Laurance says for me to tell you that we'll he making the mass-time conversion any minute now."

"Will there be warning?" Dominici asked. "Or will it—just happen?"

"You'll know about it. We'll sound a gong, for one thing. But you can't miss it."

"Thank God we're out of the solar system," Bernard said. "I thought the first leg of the trip would last forever."

Clive chuckled. "You realize you've covered four billion miles in less than a day?"

"It seems like so much longer."

"The medieval spacemen used to be glad if they could make it to Mars in a year," Clive said. "You think this is bad? You ought to see what it's like to make a plasma-drive hop between stars. Like five years in one little ship so you can plant a transmat pickup on Betelgeuse XXIX. *That's* when you learn how to be patient."

"How long will we be in warp-drive?" Stone asked.

"Seventeen hours. Then it'll take a few hours more to decelerate. Call it a day between now and landing." The little spaceman showed yellowed teeth. "Imagine that! A day and a half to cover ten thousand light-years, and you guys ere complaining!" He doubled up with laughter, slapping his thigh.

Then Clive was serious again. "Remember—when you hear the gong, we're converting."

"Should we strap down?"

Clive shook his head. "There's no change in velocity. You won't feel any jolt." He walked out, letting the bulkhead swing shut behind him.

Bernard laughed. "He's right, of course. We're idiots for being so impatient. It's just that we're accustomed to getting places the instant we want to get there. To *them*, this trip must seem ridiculously fast."

"I don't care how fast it seems to them," Dominici said tightly. "Sitting around in a little cabin for hour after hour is hell for me. And for all the rest of us."

The gong sounded suddenly, a deep, full-throated bonging chime that was repeated three times, dying away after the last with a shimmer of harmonics.

"We're making the conversion," Dominici muttered. He swung around to face the wall, and Bernard realized suddenly that the biophysicist was crossing himself.

Although not a religious man himself, Bernard wished he could commend himself in some way to a watchful deity. As it was, he could only trust to good fortune. Havig was moving his lips in silent prayer; Dominici was whispering something in Latin. Stone, evidently like Bernard a man of no church, had lost some of his cheery ruddiness of cheek.

They waited—and if the hours since blastoff from Earth had seemed long, the minutes following the gong were eternities. Bernard wondered what was supposed to happen as they made the conversion. He felt a dull vibration, heard a thrumming sound: the Daviot-Leeson generators building up potential, most likely. In a moment or two, a fist of energy would lash out, sunder the continuum, and create a doorway through which the *XV-ft1* might glide.

Into where?

Bernard could not picture it. All he knew was that it was some adjoining universe where distances were irrational figures, a universe that had been mapped in five years of experimental work and now was being piloted by men who had but the foggiest concept of where they were.

The change came

The first hint was the flickering of the lights, only momentarily, as the great power surge drained the dynamos. The only other immediate effect was a psychological one: Bernard felt cut loose, severed from all he knew and trusted, cast into a darkness so mighty it was beyond comprehension

The feeling passed. Bernard took a deep breath.

"Look at the vision port," Stone breathed. "The stars—they aren't there!"

Bernard spun around It was true A moment before, the port, a three-by-four television screen that gave direct pickup from the skin of the ship, had been dazzling with the glory of the stars. Unending cascades of brightness had glinted against the airless black.

Now all that was gone. Stars, planets, cascades of bright glory. The screen showed a featureless gray. It was as though the universe had been blotted out.

Once again the bulkhead light flashed. Stone pushed the switch to admit, this time, John Laurence himself.

"We've made the conversion successfully, gentlemen. What you see on the screen is a completely empty universe in which we're the only bit of matter."

Stone said, "In that case, what do you steer by?"

Laurance shrugged. "Rule of thumb. The unmanned ships were sent into nospace, they travelled along certain vectors that we've charted, and they came out someplace else. For lack of landmarks we just follow our noses."

"It doesn't sound like a very efficient way of getting places," Dominici said.

"It isn't," Laurance admitted. "But we don't happen to have any choice."

Laurance paused. "I came in to tell you that all was well, that we'll be eating in half an hour, and that we'll be in Star NGCR 185143's neighborhood in about seventeen hours. Ah—Mister Clive tells me you're all a bit edgy. Been doing some bickering."

Bernard reddened. There was the beginning of contempt in Laurance's eyes.

Stone said, "We've had our little disagreements, yes. Minor differences of opinion—"

"I understand, gentlemen. May I remind you that you're entrusted with great responsibility. I hope you'll have settled your — ah — 'minor differences' before we reach our destination. You'll find relaxotabs in the medical supply cabinet over there, if your 'edginess' continues. I'll expect you in the fore galley in half an hour."

When a half hour had elapsed, the four went up front for the meal. Synthetics, of course; but lovingly prepared by Nakamura and Hernandez. After the meal the passengers returned to their cabin. More than sixteen hours remained to the nospace leg of their journey.

Bernard settled into his acceleration cradle and tried to read. But it was no use; the words danced on the page.

He slept for a while, and was able to read when he woke. Looking around the cabin, he saw Dominici deep in snoreland, Havig thumbing what was probably a prayerbook, Stone peering endlessly out the vision port at nothing whatsoever. The cabin clock told Bernard that four hours remained till transition.

Bernard forced himself to stop thinking about the frictions in the cabin and to ponder the nature of the aliens waiting ahead. He had seen their photos, in tridim and color, but yet he looked forward to the meeting with complete uncertainty. Would contact be possible? And if it were, would an agreement be forthcoming? Or was the civilization of man doomed to be racked by an interstellar war that would send the centuries-old peace imposed by the Archonate crumbling?

The rise of the oligarchy, Bernard thought, had ended the confusion and doubt of the Nightmare Years. But what if the aliens refused to meet and enter into peaceful treaties? What would the strength of the Archonate be worth then?

He had no answers. He forced himself to concentrate on his reading. The hours marched past, until the gong sounded once again. Transition was made.

The vision screen exploded into brilliant life. New constellations; eye-numbing new clusters of stars, perhaps including among them a dot of light that was Earth's sun.

And, hanging before them like a blazing ball, was a golden-yellow sun darkened by the shadow of planets in transit across its disk.

CHAPTER 5

THE ship swung "downward," cutting across the ecliptic plane to seek out the orbit of the fourth of the golden star's eleven worlds. Assuming an observation orbit five hundred fifty miles above the planet, the *XV-ft1* zipped round four times before spying the alien settlement.

In the rear cabin, Martin Bernard and his fellow negotiators lay strapped in, shielded against the atmospheric buffeting of landing, waiting the minutes out as the *XV-ft1* dropped in ever-narrowing spirals toward the darkness below.

Queasiness of the stomach assailed him. His life, all their lives, lay in the hands of five bloodshot, tired men. A miscalculation in somebody's computations and they might smash into the unnamed planet below at fifty thousand miles a second.

Bernard eyed the planet growing in the viewscreen. They were too close to regard it as a sphere, now; it had flattened tremendously, and nearly a third of its area was outside the screen's subtended angle of vision.

Bernard caught glimpses of great continents lying in a blue-green sea like slabs of meat against a table. Now the bright threads of the bigger rivers could be picked out. One vast waterway seemed to travel diagonally across the biggest continent. Mountain ranges rose like buckled humps in the far west and north. Most of the continent was a verdant green, shading into a darker color toward the north and in the highlands.

Closing his eyes, Bernard choked back his dizziness and waited for the moment of landing.

It came some time later. He sensed a gentle thump. That was all.

It had been a perfect landing.

The voice of Laurance came over the intercabin speaker: "We've made our landing without trouble. Our landing-point is some ten or twelve miles east of the alien settlement. The sun is due to rise here in about an hour. We'll be leaving the ship as soon as routine area decontamination is carried out."

The routine decontamination took only a few minutes. Then, once all radiation products incident to the landing had been sluiced away, the hatch slid open and the air of another world came filtering into the ship.

It was much like Earth's; but there was a fraction more of oxygen in it, not enough of an overplus to jeopardize health but just enough to give the air a rich, heady quality. It was almost like breathing fine white wine.

A fresh morning breeze, slightly chill, swept down across the meadow in which they had landed. The sky was still gray, and a few last stars of morning still glimmered faintly. But pink streaks of dawning were beginning to splash across the sky. The temperature, Bernard estimated, was in the forties or fifties: promise of a warm morning. The air had the transparent freshness one found only on a virgin world.

It might have been Earth on some ninth-century morning, thought Bernard. But there were differences. The blue-green blades of grass sprouted triple from the stalk, twisting round each other in a complex pattern before springing upward. No grass on Earth had ever grown in such a way.

The trees — looming evergreens two hundred feet high, their holes a dozen feet thick at the base—had cones three feet long dangling from them; the bark was pale yellow, ruffled by horizontal striations; the leaves were broad glossy green knives, a foot long, two inches wide. Crickets chittered underfoot, but when Bernard caught sight of one he saw it was a grotesque creature three or four inches long, green with beady golden eyes and a savage little beak. Great oval toadstools with table-like tops a foot or more in diameter sprouted everywhere in the meadow, bright purple against the blue-green. Dominici knelt to touch one and it crumbled like a dream when his finger grazed the fungus' rim.

Laurance said quietly, "We'll proceed to the alien village on foot. There are two landsleds in the ship, but I'm not going to use them. It might look too much like an armed invasion to the aliens if we came rolling up in landsleds."

"How about weapons?" Dominici said. "Do you have enough to spare for the four of us?"

Laurance tapped the magnum pistol at his side. "I'm carrying the only weapon we'll need."

"But—"

"If the aliens react to us with hostility," said Laurance in a dry voice, "you may quite possibly all become martyrs to the cause of Terran diplomacy. I'd rather see us all shot down by alien blasters than to have some jumpy negotiator fly off the handle and pump bullets into them."

He turned, checking his position against a compass embedded in the sleeve of his leather jacket along with several other indicators, and nodded toward the west. Without further ado he began to walk. Nakamura and Peterszoon fell in behind him, Clive and Hernandez back of them. No one looked around to see if the negotiators were following.

Shrugging, Bernard scurried after the five retreating spacemen, Dominici jogging alongside. Stone followed, with gloomy Havig bringing up the rear.

"They don't treat us as if we're very important," Bernard said to Dominici. "They seem to forget that we're the reason they're here."

"They don't forget it," Dominici growled. "They just feel contempt for lazy Earthblubbers like us. 'Transmat people,' they call us, with a sort of sneer in their voice. As if there's something morally wrong with taking the quickest possible route between two points."

"It does breed some bad habits," Bernard said. "We lose a sense of appreciation of the universe. Since the transmat was invented we've forgotten what distance means. We don't think of *time* as a function of distance any more; they do. And to the extent that we can't control our impatience, we're weaklings in a spaceman's eyes."

They fell silent. The path was on a slight upgrade, and despite the tiny extra percentage of oxygen in the air Bernard soon found himself puffing and panting. Anxiety-toxins were flooding his body now, willy-nilly. The poison of fear added to the fatigue of his muscles, slowing him down.

But Laurance and his men, up ahead, never flagged. They strode on, clearing a way through the sometimes impassable brush, detouring to circle a fallen tree whose man-high trunk blocked the path, pausing to estimate the depth of a stream before plunging across.

Bernard had never realized that the abstract term "ten miles" meant quite so many weary steps. His feet felt numb, his calves stiff, his thighs already developing a charley-horse, after only half an hour's march.

But there was no help for it but to plug gamely on.

At the end of the first hour they rested, leaning against the massive stumps of fallen trees that lined their path.

"Tired?" Laurance asked.

Stone nodded; Bernard grunted his assent. A twinkle appeared in Laurance's eyes. "So am

I," he admitted cheerfully. "But we'll keep going."

The sun rose finally a few minutes after they had resumed their trek. It burst into the sky gloriously, a young sun radiant in its youth. The temperature continued to climb; it was above seventy, now. Bernard realized bleakly that it was likely to reach ninety or better by high noon. He remembered that medieval jingle: *Mad dogs and Englishmen go out in the midday sun.* He smiled at the thought, flicked sweat from his forehead and grimly forced his legs to continue carrying him forward.

CHAPTER 6

IT BECAME purely mechanical after a while, and he stopped feeling sorry for himself and concentrated all his physical and mental energy on dragging one leg after another. And the yards lengthened into miles, and the distance between the spaceship and the alien encampment shrank.

Up ahead, the procession came to a halt. Laurance and his men had stopped at the summit of a gently rising hill. Peterszoon was pointing into the valley, and Laurance was nodding in response.

As Bernard caught up to them, he saw what they were pointing at in the valley. It was the alien settlement.

The colony had been built on the west bank of a fast-flowing river about a hundred yards wide.

In the colony, furious activity seemed to be the order of business. The aliens scurried like energetic insects.

They had built six rows of domed huts, radiating outward from a larger central building. Work was proceeding—no, boiling ahead—on other huts that would extend the radii of the colony's spokes. In the distance, gouts of dirt sprang high as the aliens, using what seemed to be a hand-gripped excavating device of force-field nature, dug out the foundations for yet more of the six-sided, stiff little huts.

Some thousand yards to the north of the main scene of activity stood a massive blue spaceship—adhering in the main to the cylindrical form, but strangely fluted and scalloped in superficial design to provide an unmistakably alien effect.

After he had taken in the first surprising sight of the furiously energetic colonizers, Bernard turned his attention to the aliens themselves, not without a chill. At this distance, better than five hundred yards, it was hard to see the creatures in great detail. But they bore themselves upright, like human beings, and only their skin coloration and the odd free-swinging motion of their double-elbowed arms bore witness to their unearthliness.

They came in two sorts: the green ones, which were overwhelmingly in the majority, and the blue-skinned ones. These seemed to be overseers; color-supremacy, he wondered? It would be interesting sociologically to run into a species that still practiced color-dominance.

The blue aliens were definitely in charge, shouting orders that could just barely be heard on the hillside. And the green ones obeyed. The colony was being assembled in almost obscene haste.

"We're going to march down the hillside and right into that colony," Laurance said quietly. "The important thing to remember is not to show any sign of fear. Dr. Bernard, you'll march in front with me. Dominici, Nakamura, Peterszoon, follow right behind us. Then Stone, Havig, Clive, Hernandez. It'll be a kind of blunt-tipped triangle. Stay in formation, walk slowly and calmly, and whatever you do don't show any sign of tension or fear." Laurance glanced quickly around the group. "If they look menacing, just smile at them. *Don't* break and bolt unless there's an out-and-out attack on us. Stay calm, levelheaded, and remember that you're Earthmen, the first Earthmen ever to walk up to an alien being and say 'hello.' Let's do it the right way. Dr. Bernard, up front with me, please."

For a long moment it seemed as though the aliens would never notice the nine Earthmen filing toward them. The nonterrestrials were so busy with their construction tasks that they did not look up. Laurance and Bernard advanced at a steady pace, and they had covered perhaps a hundred paces before any of the aliens reacted to their arrival. Then one did.

The first reaction came when a worker stripping felled logs happened to glance up and see the Earthmen. The alien seemed to freeze, peering uncomprehendingly at the advancing group. Then he nudged his fellow-worker in an amusingly human gesture.

"They see us now," Bernard whispered.

Consternation appeared to be spreading among the green-skinned workers. They had virtually halted all construction now to stare at the newcomers. Closer, Bernard could make out their features; their eyes were immense goggling things, which gave them a look of astonishment which perhaps they did not feel inwardly.

The attention of one of the blue-skinned overseers had been attracted. He came over to see why work had stopped; then, spying the Earthmen, he recoiled visibly, double-elbowed arms flapping at his sides in what was probably a genuine reaction of surprise.

He called across the construction area to another blueskin, who came on a jogtrot after hearing the hoarse cry. With cautious tread the two aliens moved toward the Earthmen, taking each step with care and obviously remaining poised for a quick retreat.

Only a hundred feet separated the two aliens from Bernard and Laurance. The remaining nonterrestrials had ceased work entirely, and were bunching together behind the two blueskins.

The sun was merciless. Bernard's shirt plastered itself to his skin. He murmured to Laurance, "We ought to show some gesture of friendliness. Otherwise they may get scared and gun us down just to be on the safe side."

"All right," Laurance whispered. In a louder voice he said, without turning his head, "Attention, everyone: slowly bring your hands up and hold them forward, palms outward. *Slowly!* That might convince 'em that we're coming with peaceful intentions."

Heart pounding, Bernard slowly lifted his arms and turned his palms forward. Only fifty feet separated him from the aliens, now. They had stopped moving.

He studied the two blueskins. They seemed to be about the average height of a man, possibly a little taller—as much as six-feet-two or three. They wore only a loose, coarsely woven, baggy yellow garment round their waists.

The aliens had no noses as such, merely nostril-slits covered with filter-flaps. Their mouths were lipless; their faces in general had little fat, and it seemed as if their skin were stretched drum-tight over their bones. When they spoke to each other, Bernard caught glimpses of red teeth and a tongue so purple it was practically black. So they differed from Earthmen in pigmentation and in most of the minor details—but the overall design was roughly the same, as if only one pattern could serve for intelligent life.

The aliens' arms fascinated him. The double elbows seemed to be universal joints that swivelled in any direction, making the aliens capable of doing fantastic and improbable things with their arms.

The greenskins seemed to be very much like their blue overseers, except that they were shorter and thicker of body. It seemed fairly obvious that the greens were designed for working, the blues for directing.

A third blue appeared, crossing diagonally from the side of the settlement to join his two colleagues.

When they were ten feet from the aliens, Laurance halted. "Go ahead," he muttered to Bernard. "Communicate with them. Tell them we want to be friends."

The sociologist took a deep breath. He felt limp. His mind spun. What to say? *We are friends. Take us to your leader. Greetings, men of another world!*

There was no help for it, he thought. The old cliches had become cliches precisely because they *were* so damnably valid; what else were you supposed to say when making first contact with nonterrestrials?

"We are Earthmen," he said, enunciating each syllable with painstaking crispness. "We come from the sky. We wish to be friends."

He pointed to himself and to the sky. Then, tapping his chest, he said, "I." He pointed to the aliens, slowly, not wanting to alarm them. "You. I—you. I—you—friends."

Bernard waited, and behind him eight other Earthmen waited, sharing his tension. He stared levelly into the bulging eyes of the foremost blueskin. Cautiously he extended his hand. "Friend," he said.

There was a long silence. Then, hesitantly, the blueskin lifted his hand, swivelling it upward in that startlingly fluid motion. The alien stared at his hand as if it were not part of him. Bernard glanced quickly at the hand too: it had seven or eight fingers, with a sharply curved thumb. Each finger sprouted an inch-long blue nail that protruted menacingly.

The alien reached out, and for a fraction of an instant the calloused blue palm touched Bernard's. Then, quickly, the hand dropped away.

The alien made a sound. It might have been a guttural grunt of defiance—but to Bernard it sounded something like "Vvvrennddt!" and he took the sound at face value. Smiling, he nodded at the alien and repeated: "Friend. I—you. You—I. Friend."

The repetition came, and this time it was unmistakable. *"Vvvrennddt!"* The alien seized Bernard's outstretched hand and gripped it tightly. Bernard grinned in triumph and satisfaction.

For better or for worse, the first contact had been made with the aliens.

CHAPTER 7

WITHIN a week, there was communication, of a rough, uncertain sort.

There was never any question of who was to learn whose language. The aliens spoke a vastly inflected tongue that involved variations in pitch, timbre, and intensity. On physiological grounds it was impossible for the Earthmen to learn the alien language. So the aliens would have to learn Terran.

They took to it readily enough. Havig, as the team's linguist, had charge of the project, and for long hours each day the eight other Earthmen acted out charades to demonstrate Terran verbs.

It seemed impossible that a language could be learned this way—but the aliens had retentive memories, and Havig approached the job of teaching them as if it were his sacred duty in the cosmos. By the time the sun began to dip toward the low hills behind the colony, several key concepts had been established: *to be, to build, to travel.*

The aliens seemed pleased with their new knowledge. They tapped their bony chests and exclaimed, "I—Norglan. You—Terran."

"I—Terran. *We*—Terrans."

"Terrans come. Sky. Star."

Night was falling, though; and the day's heat was dwindling rapidly. Evidently this was a zone of dynamic temperature contrasts, with the mercury cycling through a range of fifty or sixty degrees a day.

"Tell them we've got to leave," Laurance said to Havig. "Find out if they have vehicles and can give us a ride back to our ship."

It took Havig fifteen minutes to get the idea across, with the aid of much body - moving and frustrated arm-gesticulation. The blueskins squatted calmly as Havig performed, repeating words now and then as it suited their fancy. Bernard looked forward dismally to another ten-mile jaunt shipward in cold and darkness. But, finally, a spark of understanding glimmered. One of the blueskins rose to his feet in a quick, anatomically improbable motion, and barked stern orders to a waiting greenie. The latter disappeared immediately.

Moments later three small vehicles that looked much like landsleds came trundling forward, each driven by a greenskin. The blueskin whose command of Terran was most secure pointed to the ears and said, "You. Terrans. Travel."

The cars were driven by some sort of turboelectric generator, and they seemed to have a top speed of about forty miles an hour. The greenskins drove impassively, never saying a word, simply following in the direction Laurance pointed out to them. When they came to streams, they simply rolled on through like miniature tanks. The trip back to the *XV-ft1* took less than an hour, even figuring in detours round impassable wooded areas. When the Earthmen stepped out of the little cars, the greenskins left without a word.

As they clambered into their ship, the Earthmen were equally silent. It had been a long, exhausting day. Bernard had never been wearier.

But even with the fatigue, it was impossible not to feel a deep sense of pride and accomplishment. Earth had met another race today, and there had been communication.

When Bernard woke, Nakamura was standing over his bunk shaking him and grinning. "Time, Dr. Bernard. Commander Laurance says you've done enough sleeping."

Commander Laurance was right; a glance at the clock told Bernard that he had slept twelve hours.

It was an hour past sunrise. The day on this planet was twenty-eight Terran Absolute Hours and twenty minutes long. Bernard joined the others for breakfast.

When they reached the Norglan settlement, about an hour later, the scene was much as it had been the day before: the builders were at work with the same fierce energy. The three blueskins who were involved in the language lessons came to greet the Earthmen, offering a vocabulary display by way of salutation: "I—you. Travel. Come. Here. We—Norglans. You—Terrans."

During that day, and the next, and the next, Havig labored tirelessly while the other Earthmen sat by, more or less useless except to serve in verb-dramatizing charades. Bernard found the lengthy sessions tremendously draining on his patience. There was little he could do but sit in the broiling sun and watch Havig perform.

And the performance was incredible. On the fifth day, the Norglans were putting together plausible sentences out of a fund of nearly five hundred words. And though they fumbled and forgot and became confused some of the time, it was evident that they were fantastically quick learners. Five words out of six seemed to stick the first time. And, of course, the broader their linguistic base became, the simpler it was to teach them new words.

By the seventh day, enough of a mutual understanding had been reached to begin negotiations in earnest. The first order of business was setting up a place to meet; squatting in the open while colony-building went on all around was not ideal. At Havig's suggestion, the Norglans erected a tent in the middle of the colony area where further discussion could take place.

In the tent, a rough wooden table had been rigged. The aliens sat on their heels at one side; apparently they had no use for chairs. The Earthmen, in the absence of seats, adopted a crosslegged squat.

Havig said, "This Earthman is called Stone. He will talk to you today."

Stone threaded a tortuous verbal path, with much help and correction from Havig. After two hours he had succeeded in establishing several vital points:

That Earth was the nucleus of a colonial empire.

That the Norglan home world, wherever it was, was a similar center of colonial expansion.

That some sort of conflict between the two dynamic planet-systems was inevitable before much time elapsed.

That, therefore, it was vital here and now to decide which parts of the galaxy should be reserved for Norglan and which for Terran expansion.

Zagidh, the biggest of the three Norglans, and his companions wrestled with these four points and appeared to show a complete understanding of what they meant. There was a brief but fervid discussion between them.

Zagidh grimaced in the now-familiar facial agony that preceded any major statement of his. The alien said slowly, "This is serious matter. I-we do not hold authority. We-you can no further talk. Others-we must come."

The four sentences seemed to exhaust the Norglan. His tongue licked out, dog-like, and he panted. Rising, he and the other blueskins exited without a further word, leaving the startled Earthmen alone.

CHAPTER 8

"WHAT do you figure this means?" Stone asked uneasily. It was half an hour since the Norglans had left the tent.

"Obviously Zagidh and his friends realized they'd stumbled into something too big for them to handle," Bernard said. "Suppose *you* were a colonial administrator busy digging wells and building shelters, and some alien beings dropped down out of the sky and told you they wanted to hold a discussion about carving up the universe? Would you sit down and write a treaty on your own hook—or would you pass the buck back to the Archonate as fast as you could?"

There was nothing to do now but wait. Bernard scowled. This entire mission was a first-class education in patience. Laurance and his men sat quietly in the corner, no longer active participants in the negotiations, simply letting the minutes trickle past. Havig, with his Neopuritan self-control, showed no outward manifestation of impatience.

Now it was three hours since the Norglans had made their abrupt exit. Mid-afternoon had come; a blistering shroud of heat lay over the clearing, but the greenskins toiled on without seeming to mind.

"We'll wait around until sundown," Laurance said. "If they don't come back by then, we'll go back to the ship and try again tomorrow morning."

The tentflap parted and three aliens entered. The first was Zagidh. Behind him came two Norglans of massive stature, their skins a deep, rich bluish-purple. They were clad in elaborate gem-encrusted robes, and their entire bearing was regal. Zagidh sank into the familiar heels-to-thighs squat. The newcomers remained standing.

Grimacing terribly, Zagidh said, "Two — *kharvish* — have come from Norglan. To speak. Time taken—learning the Terran talk. They-we will talk to you."

Still squatting Zagidh duck-waddled out of the tent. The two big Norglans lowered themselves now in one smooth simultaneous motion into the standard squat.

Haltingly, but in a voice whose tone was the mellow boom of a fine 'cello, one of the big Norglans said, "I am label Skrinri. He is label Vortakel. He—I—we both—label *kharvish*. How you say? One-who-comes-to - talk - to - others - of - other kind."

"Ambassador," Havig suggested.

Skrinri repeated it. "Am-bas-sa-dor. Yes. Ambassador. From Norglan. From home planet."

Stone asked, "You have come to talk to us?"

"Yes. You are from Earth. Where is Earth?"

"Much distant," Stone said. "How can I convey it to him, Havig? Would he know what a light-year means?"

"Not unless he knows what a year is first," Havig said. "Better let it go by."

"Okay," Stone said. Facing the Norglans he said, "Your world is close?"

"All worlds are close. It takes no time to travel there to here."

Sweltering in his corner of the tent, Bernard followed the evolving chain of reasoning.

Gradually, the similarities between the two empires began to unfold.

The Norglans had the transmat, it seemed: Skrinri and Vortakel had come from the mother world only a few hours ago via some form of instantaneous transportation. The spaceship looming above the settlement was testimony that the Norglans also had some form of conventional space travel, probably a near-light drive but nothing faster-than-light.

Concrete information on distances was a good deal more difficult to elicit. But it was reasonable to guess that the home world of the Norglans was somewhere within three or four hundred light-years of the present planet, maybe less, probably not more. Which meant that the Norglan sphere of colonization was roughly of the same order of magnitude as the Terran.

So much was clear. But yet the real issue had not even been mentioned yet. Stone was working up to it closely, building a dazzling pattern of ideas and communicated information before he got down to actual business.

Outside the tent, night was falling. The temperature drop came swiftly. A cold wind scudded across the clearing, flicking open the tentflap. Hunger-sounds growled in Bernard's belly. But the Norglans showed no indications of wishing to suspend negotiations for the night.

Stone was sketching diagrams in the packed-down dirt floor of the conference tent. A dot with a circle around it: Earth's sphere of colonization. At a distance of several yards, another dot, another circle: Norgla's sphere.

Beyond those, other dots; no circles. These were the uncolonized stars, the *terrae incognitae* of the galaxy, which neither Earthman nor Norglan had reached at this stage of the galactic expansion.

Stone said gravely, "Earth people spread outward from Earth. We settle on other worlds."

He drew radial spokes projecting from the circle that was the Terran sphere of dominance. The spokes reached into the neutral area.

"Norglan people spread outward too. You build your colonies, we build ours."

Spokes grew from the Norglan sphere as well. Dragging his stick doggedly through the ground, Stone extended the Norglan spokes until some of them all but grazed Terran ones.

"You settle here," Stone said. "We settle *there*. We continue settling new worlds. Soon *this* happens—"

Stone sketched it graphically. Two spokes met, crossed. Others intersected as well.

"We reach the same territory. We fight over this world or that. There would be war between Earthman and Norglan. There would be death. Destruction."

Skrinri and Vortakel stared at the diagram on the ground as if it were the symbology of some complex rite. Their fleshless faces gave no hint of the thoughts passing through their minds.

Vortakel said slowly, "This must not happen. There must be no war between Earthman and Norglan."

Bernard leaned forward, chafing a little at his role as a spectator, but as tense as if he were conducting the negotiations and not Stone. Despite the chill, despite the hunger, he felt a pounding surge of triumph swelling in his breast. The aliens had understood; there had been two-way communication; the Norglan ambassadors realized the grave dangers of war. The conflict would be averted. The paths of empire would swerve from their collision course.

Stone said, "We must choose the way of peace. Norglan leaders and Terran leaders will meet. We will divide the stars between us." He paused, making sure the ambassadors comprehended the meaning of *divide*. "We will draw a line," Stone went on, emphasizing his words by scratching a boundary between the two spheres of dominion on the ground.

Stone smiled. "All these worlds"—he made a sweeping gesture over the left-hand side of his sketch—"will be Norglan. No Terrans will settle there. And on this side—" he indicated the Terran domain—"no Norglans may come. These worlds will be Terran."

The aliens were silent, peering down at the lines scrawled in the dirt. They appeared to grasp the meaning of the lines.

"We understand," said Skrinri slowly and heavily.

The wind whipped furiously at the tent, whicking the loose flap back and forth. Rising from the squat he had maintained with so little discomfort for so long, Skrinri stepped forward to tower over Stone's diagram. He stood still only a moment.

Carefully placing one huge bare foot over the lines, the Norglan rubbed out the boundary Stone had drawn to delimit the proposed Norglan and Terran sectors. Then, kneeling, Skrinri obliterated with his fingers every one of the spokes of expansion Stone had depicted as radiating from the Terran sphere.

Skrinri's voice was level, somber, without any hint of malice. He made a broad gesture with both hands, as if to take in the entire universe.

"Norgla builds colonies. We expand. You—Earthmen—have occupied certain worlds. You may keep these worlds. We will not take them away. All other worlds belong to Norgla. We do not have to talk further."

With calm dignity, the two Norglans made their way from the tent. In the shocked silence that followed, the wind rose to a mocking screech.

All other worlds belong to Norgla. Stunned, the nine Earthmen stared white-face at each other. No one had expected *this*.

"It's a bluff!" Dominici whispered harshly. "Limiting us to present holdings? They can't mean it!"

"Perhaps they can," Havig said quietly. "Perhaps this is the end of our fine dream of galactic colonization. And perhaps this is a disguised blessing. Come: we'll accomplish no more here today."

The Earthmen filed out of the tent, into the alien darkness, into the suddenly hostile wind.

CHAPTER 9

MORNING came slowly. The little red moon twirled across the sky and was gone; the unfamiliar constellations passed above and lost themselves beyond the horizon. As the hours of night gave way to the hours of dawn, the men of the *XV-ft1* busied themselves in the routine tasks of daybreak. No one had slept that night aboard the ship.

"We shouldn't have let them march out of there like that," Stone said bitterly. "They stalked out like a couple of princes giving the word to a rabble of commoners. We should have made them stay, let them know that Earth wasn't going to listen to their high-handed nonsense."

"'*You may keep these worlds,*'" Dominici repeated in harshly sardonic tones. "'*All other worlds belong to Norgla.*' As if we were worms!"

"Perhaps it was the will of God that man's expansion through the heavens come to a halt," Havig suggested. "The Norglans have been sent as a reminder that pride is sinful, that there are limits beyond which we dare not go."

"You're making the assumption that the Norglans are a genuine limit," Bernard said. "I don't think they are. I don't think they've got the technology to keep us penned into our present sphere. They sound like bluffers to me."

"I'll go for that idea," Dominici said. "What I saw of their science didn't impress me. They've got spaceships and transmats, but nothing that's qualitatively advanced over what we've got. In a war we could hold our own with them."

"But why a war?" Havig asked. "Why not accept the decree and keep within our limits?" He answered his own question immediately. "I know. We do not accept limits because we are Earthmen. and in some mysterious way Earthmen have a divine mandate to spread throughout the entire universe." Havig smiled darkly. "None of you pay attention to what I say, of course. You think I'm a religious crank, and in your eyes I suppose I am. But is it so utterly wrongheaded to be humble, gentlemen? To draw back our frontiers and say, Thus far and no further shall we go? When the alternative is bloody warfare, is it cowardly to choose the path of peace?"

Bernard looked up. "I'll grant the strength of what you're saying, Havig. None of us wants war with these people. And maybe it isn't man's destiny to colonize the universe. I can't answer for what is or isn't our destiny. But I know enough about psychology to figure these people out, alien though they are. Right now they're being tolerant, in a lordly way—they'll let us keep our piddling little empire, provided we leave all the rest for them. But their tolerance won't last forever. If all the rest of the universe becomes Norglan, some day they're going to cast covetous eyes at us and decide to make it a clean sweep. If we give ground now, we're inviting them to come wipe us out later. Dammit, Havig, there's a difference between being humble and being suicidally meek!"

"So you think we should make war on Norgla?"

"I think we should go back to them today and let them know we aren't going to let ourselves be bluffed," Bernard said. "Reject their ultimatum. Maybe that's simply their alien way of negotiating: begin with an absurd demand and work backward to a compromise."

"No," Dominici said. "They want war. They're spoiling for it. Well, we'll give it to 'em! Let's tell Laurance we're heading for home. We'll toss the whole business in the Archonate's lap and wait for the shooting to start. That's the way to handle it."

Stone shook his head mildly. "Bernard's right, Dominici. We have to go back and try again. We can't just go storming off to Earth like hotheads. Or even go meekly crawling away with our tails dragging, as Havig would like. We'll give it another try today."

The cabin door opened, and Laurance, Clive, and Hernandez entered. They, too, had been up all night, or so it looked from their paleness of face and redness of eye.

Laurance forced a smile. "It's almost morning. I see you haven't done much sleeping."

"We've been trying to figure out whether we ought to try another session with the Norglans," Bernard said.

"Well? What was the decision?"

"We aren't sure. Matter of fact, we seem to be split down the middle on the subject."

"What's the point of disagreement?" Laurance asked.

"I feel it's time for mankind to pull in its horns," Havig said with an apologetic smile. "Our friend Dominici wants to go home too, but for the opposite reason: he doesn't think it's worth talking to the Norglans again."

"Damn right I don't," Dominici snapped. "They've as much as told us they dare us to make war. Now we ought to show them—"

"I'm willing to withdraw my objections to another session," interrupted Havig calmly. "Something in me suggests that going home now would lead only to war. I join forces with Dr. Bernard and Mr. Stone. Let's talk to the Norglans again."

Bereft of his ally, Dominici stared around uncertainly. All eyes were on him. After a moment he frowned and said grudgingly, "All right. I'll make it unanimous, I suppose. But we aren't going to get anywhere."

They set out an hour after sunrise for the Norglan settlement. The heat was beginning already. Plants whose leaves had rolled tight against the evening frost now uncoiled them, spreading them flat to soak in the sunlight.

When they reached the encampment, the Earthmen strode into the center of the colony together, Bernard, Stone, and Laurence leading the way. Zagidh came forward to meet them.

"You have come back," he said flatly.

"Yes. We wish to talk with Skrinri and Vortakel again," said Stone. "Tell them we are here."

Zagidh swung his swivel-jointed arms loosely. "The *kharvish* are gone."

"Gone?"

"We-they told we-I they did not talk to you-they again," Zagidh said.

Stone frowned, puzzling out the complexities of the blueskin's version of Terran. "We had not ended talking to the *kharvish*. Get them as you did yesterday."

Zagidh's arms continued to swing. "I can do not. They did not want to talk to you-they again."

From the back of the group came Dominici's bitter voice.

"They've delivered their ultimatum and now they're gone. We're wasting our time jabbering with this blueface. Do we have to have things made any clearer for us?"

Patiently, Stone tried it from several other approaches. But the result was the same. Skrinri and Vortakel were gone, back to the mother world. They had nothing further to say to the Earthmen. And no, Zagidh would not summon them a second time. Why should he? The position was plain enough. Skrinri had ordered the Earthmen not to colonize any more worlds. Did that statement require clarification, Zagidh asked?

"Don't you see this will be war between Norgla and Terra?" Stone demanded, exasperated. "Innocent people will die because of your stubbornness! We *have* to talk to the *kharvish* again."

Zagidh swung his forearms faster, now; it looked like a gesture of growing irritation. "I have said the words they gave me to say. I must build now. You go. The *kharvish* do not come back."

With one final annoyed flap of his arms, Zagidh spun away and instantly began to shout instructions to a group of greenskins struggling across the clearing with a heavy crate of equipment. The Earthmen, ignored, stood by themselves unshaded in the fierce sunlight.

"I think that's about it," Bernard said quietly. "We've had it. Maybe they're bluffing, but they're bluffing hard."

They returned to the sleds, and drove slowly out of the Norglan encampment. Turning to glance back, Bernard saw that nobody was watching their departure. None of the Norglans cared.

They travelled through the rolling meadows and over the by-now well-worn forest path to the ship. Bernard's heart felt like cold lead behind his ribs. He shuddered at what they would have to tell the Technarch when they returned to Earth, only a few days hence. McKenzie would be furious.

From the front of the sled, Clive chuckled. "You know, we could have gone along for thousands of years without ever running into these Norglans. If we hadn't built the *XV-ft1*, if we hadn't happened to blunder onto a Norglan-settled planet, if the Technarch hadn't decided to negotiate in advance of the conflict—"

"That's a lot of *ifs*," Bernard said.

"But they're valid ones," Clive protested. "If we'd minded our own business and expanded at a normal rate, none of this would have happened."

"That's pretty close to treason your man is talking," Stone said quietly to Laurance.

"Let him talk," the spaceman replied with a shrug. "We've listened to the Archons all along, and where's it getting us? Just back into the same muck of war that the Archonate was established to abolish, so—"

"Laurance!" Bernard snapped.

Laurance smiled. "So I'm talking treason too? All right—hang me on the tree next to Clive. But this will be Technarch McKenzie's war we'll be fighting, by the Hammer! And win or lose, it may bring the Archonate tumbling down."

CHAPTER 10

LAURANCE'S defiant words remained with Bernard as he boarded the ship and made his way to the passenger cabin to await blastoff. It was not often that you heard anyone openly expressing antagonism to the Archonate.

It was strange to think of criticizing the Archonate or a specific Archon. To do so was virtually to demonstrate an atavistic urge to return to the dreadful confusion of pre-Archonate days.

The Archons had ruled Earth since the dim days of the early space age. The First Archonate had risen out of the nightmare anarchy of the twenty-second century; despairing of mankind, thirteen strong men and true had seized the reins of command and set things aright.

And, training and choosing their own successors, the Archonate had endured, a continuing body holding supreme authority, by now almost sacred to Terrans of whatever planet. The pattern of the past argued that no empire sustained itself indefinitely. In time each made its fatal mistake, and gave way to a successor.

Was the cycle of the Archonate ended now, Bernard asked himself as he waited for blastoff? McKenzie's rash thrust into interstellar space now threatened to bring war down on Terra—war whose outcome might shatter the peace of five centuries and cast the Archonate into limbo with the other discarded rulers of man's eight thousand years.

Nakamura entered the cabin. "Commander Laurance says he's ready to go."

The signal came not much later. With landing jacks and stabilizing fins retracted, the *XV-ft1* sat poised in its meadow, while ten miles away unheeding aliens built their colony. A thunder of ions drove the ship upward.

Acceleration ceased at last. Velocity became constant. They could relax.

Some time later, the warning gong began to sound. Bernard went tense. They were entering the nospace void, which meant that less than a day hence they would be landing on Earth. He found no joy in the thought of homecoming. *In the ancient days,* he thought, *a messenger who bore bad news was killed on the spot. We won't be as lucky. We'll go on living—known for all time as the men who let* *ourselves be walked over by the Norglans.*

The cabin lights flickered and the screen winked into featureless grayness. Conversion had been made.

Now there would be seventeen hours of unending waiting. Bernard found his cabinet and took out a slim book.

Shall I compare thee to a
Summer's day?
Thou art more lovely and more
temperate:
Rough winds do shake
the darling buds of May—

Bernard sighed in frustration and let the book slip shut. It was no use; no use at all. The face of Skrinri kept getting between him and the page. Concentration was impossible; too many extraneous fears intervened. His hands were cold with tension. He paced the narrow cabin. The viewscreen showed nothing but gray.

The cabin was silent. Havig was sunk in that impenetrable cloak of abstraction of his, communing with his God; no use seeking company there. Dominici had gone to sleep. Stone stared at the viewless vision screen, no doubt thinking of his shattered diplomatic career. A man who goes forth to negotiate a treaty and returns with an enemy ultimatum jammed down his gullet does not rise to the Archonate.

Bernard made his way forward into the control cabin at the nose of the ship. The door was open. Within, he could see all five of them at work, parts of the same organism, extensions of the ship. For minutes, no one took notice of the sociologist as he stood at the entrance to the control cabin. They were immersed in their duties.

Then Laurance saw him. Turning, the Commander's eyes narrowed; his face, Bernard thought, looked strangely rigid, almost tortured. "Sorry, Dr. Bernard. We're very busy. Would you mind remaining in your cabin?"

Rebuked, Bernard returned to the passenger half of the ship. Nothing had changed. The clock showed that nearly fourteen hours of nospace travel remained.

He was growing hungry. But as the clock-hands crawled on, no one appeared from the crew to announce that it was mealtime. Bernard waited.

"Getting hungry?" Stone asked.

"Plenty. But they looked busy up front when I went fore," Bernard said. "Maybe they can't take time out for a meal break yet."

"We'll wait another hour," Stone decided. "Then we eat without them."

The hour went by, and half an hour more. Stone and Bernard went fore. Tiptoeing past the galley, Bernard glanced into the control cabin and saw the five crewmen as frantically busy as ever. Shrugging, he stole away again, unnoticed.

"They don't look like they plan to eat," he told Stone. "We might as well help ourselves."

He prepared the synthetics with something less than Nakamura's culinary skill, and they ate a silent meal. It was the seventh hour of nospace travel by the time they finished.

Returning to the cabin, Bernard settled himself in his bunk. He lay back, nestling his head on his hands, and dozed for a while. When he woke, six hours remained. He was hungry again.

"You haven't missed a thing," Dominici assured him. "They're awfully busy up front."

"Still?" Bernard asked. He began to feel uneasy.

The hours trickled away. Three hours left, two, one. He counted minutes. The seventeen-hour nospace interim had expired. They ought to be converting back. But no news came from the control cabin.

When they were three hours past the conversion time, Bernard said through lips dry with tension: "Maybe we ought to go up front and find out what's what?"

"Not yet," Stone said. "Let's be patient."

They tried to be patient. Only Havig succeeded, sitting wrapped in his unbreakable calm. Another hour went by, more tortuously than any of the others. Suddenly the gong sounded, three times, reverberating through the entire ship.

"At last," Bernard muttered. "Four hours late."

The lights dimmed; the indefinable sensation of transition came over them, and the viewscreen blazed with light. They had returned to the universe!

Then Bernard frowned. The viewscreen—

He was no astronomer, but even so he spied the wrongness. These were not the constellations he knew. The stars did not look this way in the orbit of Pluto. That great blazing blue double, with its attendant circlet of smaller stars—he had never seen that formation before. Panic swirled through him.

Laurance entered the cabin suddenly. His face was paper-white, his lips bloodless.

"What's going on?" Bernard and Dominici demanded in the same instant.

Laurance said quietly, "Commend yourselves to whatever gods you happen to believe in. We went off course the moment we converted yesterday. I don't know where we are—but it's most likely better than a hundred thousand light-years from home."

CHAPTER 11

"YOU mean we're *lost?*" Dominici asked, his voice rising to an incredulous screech.

"I mean just that."

"Why didn't you tell us about this before?" Bernard demanded.

Laurance shrugged. "We were

making course compensations trying to find our way back to the right path. But it didn't work. There wasn't even a trace of a single one of our course referents. And everything we did only seemed to make things worse." Laurance's shoulders slumped wearily. "We decided to give up trying, a little while ago, and converted back to the normal universe. But there isn't a single familiar landmark. We're as lost as can be."

"How could such a thing happen?" Stone wanted to know. "I thought our course was pre-set —everything calculated automatically in advance—"

"To a certain extent, yes," Laurance agreed. "But there were the minute adjustments, the position feedbacks, and somewhere along there we went astray. Maybe it was a mechanical failure, maybe a human error. We don't know."

"Does it matter *now?*" Bernard said.

"Hardly. A millionth of a second of parallax error—widening into an enormous departure from course almost instantly. And so—here we are."

"Where?" Stone asked.

"The best I can offer you is an educated guess. We think we've emerged from nospace somewhere in the region of the Greater Magellanic Cloud. Hernandez is busy taking observations now. We've spotted one star we're pretty sure is S Doradus, and that would clinch things."

"So we're not too far from home," Dominici said with a harsh chuckle. "Only in the next galaxy, that's all. What's a mere 50,000 parsecs?"

"If we know where we are," said Stone, "shouldn't we be able to find our way back to Earth?"

"Not necessarily," Laurance replied. "Nospace travel doesn't follow any logical pattern. There's no correlation between time and distance. And no way of telling direction. Our only hope for getting home is trial-and-error computation—and it's just as reasonable to assume that on our next jump we'll wind up in Andromeda as back in our own galaxy."

Nakamura entered the cabin suddenly. In a low voice he said to Laurance, "Commander, could you come up front for a moment? There's something we'd like to show you."

The spacemen left. For a long moment there was silence in the cabin after they had gone.

Bernard stared at the vision screen. It was a breathtaking view: a sprawling field of stars, a Milky Way no human eyes had ever seen before. Blazing blue-white giants and dim red stars studded the field of vision. And down in the lower part of the screen hung a dazzling white cloud, a coil with an arm drifting loose at either end. With a jarring sense of shock Bernard realized he was looking at his own galaxy.

Bernard caught his breath. It was a numbing sight to see the galaxy from a distance of some 50,000 parsecs. It tended to provide a different perspective on things, to demonstrate beyond the power of all words to convey how small was man and all his aspirations, how unintelligibly mighty the universe. At this distance no single star of the home galaxy could be discerned by the unaided eye.

Stone laughed bitterly. "Which is worse?" he asked. "To get lost fifty thousand parsecs from home—or to return to Earth with the Norglan ultimatum? Me, I almost think I'd rather stay lost."

"Not me," Dominici retorted. "I'd survive the Technarch's anger, and maybe even the war with the Norglans. It wouldn't have been so bad with a couple of women on board, but to be stranded this way? Nine Adams and no Eves? Uh-uh. Not for me, friends."

Bernard continued to stare at the alien sky in the vision screen. Ten thousand light-years had seemed so far from home, once. But it wasn't, not really. Earth and Norgla were next-door neighbors, at this distance. *And to think that we were set to divvy up the universe between us! What right do any of us, in our puny little galaxy, have to stake claims out here?*

"I'd like to get back home," he said mildly. "I miss my books, my music, even my classes—"

"No family?" Dominici asked.

"Not really. Two marriages; both dissolved."

"I never married," Stone said, "so in a sense I don't have much to go home to. But I don't want to rot for the rest of my life on some strange planet. To die unmourned, alone, forgotten—"

"It would be the will of God, wouldn't it?" Dominici asked. "Everything's the will of God. Just sit back and let God pour trouble over you, and shrug your shoulders because it's His will and therefore there's no use complaining. Isn't that so, Havig? How come you haven't been spouting your usual stuff to console us. We—*Havig!*"

Sitting by himself, as usual, in his corner bunk, the Neopuritan was very quietly having hysterics. His body was being racked with great whooping sobs, but he was choking them back with almost demonic intensity. His eyes were wet with tears; his jaws were tightly clenched, his white-knuckled hands gripped the edge of the bunk. The sobs rippled up through him, and grimly he forced them back, not letting a sound escape from his mouth. The effect was astonishing.

"Havig!" Dominici snapped curtly. "Havig, what's the matter with you? Are you sick?"

"No—not sick—" Havig gasped.

"What's wrong, then? Is there anything we can get for you?"

In a low, dark, terrible voice Havig muttered, "All my life I was a good man—kept the ways of God, worked hard, prayed. Worshipped Him as I thought He must be worshipped. And—and—*this*. Lost here, billions of billions of miles from home, church, family. Wife. Children. Gone. Why? Why did He do this to me? *Why? Why?*"

The big man rose and took two tottering steps forward, eyes fixed, jaws flecked with spittle.

"Grab him!" Dominici shouted. "He's cracking up! Grab him or he'll run wild!"

They sprang toward him. Bernard and Stone each seized one enormously long, spidery arm; Dominici reached up, practically on tiptoes, to clamp his hands to the linquist's thin shoulders. Together they forced him down onto his bunk.

"Let go of me! Get your hands away from me!"

"Just lie there until you're calm," Bernard told him. "Relax, Havig. Don't snap now."

"I have committed some sin," Havig muttered in a broodingly introspective voice. "Otherwise why would He have forsaken me?"

"You're not the first to ask that question," Dominici said. "At least you're in good company there."

"Shut up, you idiot," Bernard whispered. "You want to drive him out of his mind? Get me a sedative."

"In some way I have offended Him," Havig went on. "And He has taken His light from me."

"You're wrong, Havig," Bernard said sharply. "This is a trial—a trial of your faith. God is sending tribulations upon you. Remember Job, Havig. *He* never lost faith."

Havig's eyes brightened. "Yes. A trial of my faith. Job. Yes. But I can't stand it! Lost out here—perhaps there is no God out here! And—and—"

Reaching behind him, Bernard took the sonic spraytube from Dominici and jammed it against a vein in Havig's arm. He flipped the release, injecting the fluid instantly. Havig muttered something unintelligible; his eyes glazed; within moments, he was asleep.

Rising, Bernard mopped sweat from his forehead. "Whew! *That* happened awfully fast!"

"Crazy. Absolutely crazy," Stone said.

Bernard shook his head. "It's perfectly understandable. He's a fanatic who had the rug yanked out from under him. I guess this was one time he couldn't write every trial and tribulation off to God's will. So he snapped."

"Will he be okay when he wakes?" asked Dominici.

"I hope so. I gave him enough of that stuff to keep him out for hours. Maybe he'll be calmer when the drug wears off."

"If he goes on ranting like that," said Stone, "we'll just have to gag him. Or keep him drugged. He'll drive us all nuts otherwise."

The cabin door opened. Laurance entered, followed by Clive and Nakamura.

"What's been going on back here?" Laurance asked. "I heard wild shouting—"

"Havig had a kind of fit of despondency," Bernard explained. "The universe suddenly became too much for him all at once, or something. He's conked out under sedatives now."

"It sounded like a riot," Clive said.

"He'll be okay," Bernard repeated. "What's the news? Figure out where we are yet?"

"Greater Magellanic Cloud," said Laurance.

"Is that definite?"

"About as definite as it's going to get. We've found S Doradus, bright as a beacon. And some RR Lyrae variables that we're pretty sure of. The way the stellar population scans out—plenty of Cepheids, lots of O and B stars and K-type supergiants—it fits the Magellanics, all right."

"How about Sol-type suns?" Stone asked anxiously. "Those other kinds aren't any good for landings, are they?"

"I don't think we have to worry much about that," Laurance said with a tight little nervous smile.

"What do you mean?" Dominici asked.

"I mean that matters aren't in our hands any longer."

For the first time, Bernard realized that all five of the crewmen had left the control cabin—Laurance, Clive, and Nakamura in here, Peterszoon and Hernandez waiting just outside. And if no one were in the control cabin—

"What's happening?" Bernard demanded in sudden panic. "Who's piloting the ship?"

"I wish I knew," Laurance said. He walked to the vision screen. "About half an hour ago some external force seized control of us. We're powerless to move of our own free volition. We're being dragged down as if by an invisible hand—toward a yellow sun."

CHAPTER 12

DOWN, down, down, dropping through the blackness past glittering suns, pulled like a helpless plaything—and there was nothing any of them could do about it.

The controls were jammed. The plasma jets would not fire. The stabilizer rockets were out of commission. The velocity indicators did not register. It was not even possible to switch to the Daviot-Leeson drive and convert into nospace.

Nothing to do but wait.

"Postulate an enormous magnetic field," Dominici suggested. "Something like fifty trillion gauss—a field of an intensity we can't even begin to imagine. The magnetic field of the entire cluster, maybe. And we're caught in it."

"Magnetic fields don't interfere with a spaceship's rocket tubes," Bernard said. "They don't freeze the controls. Not even a hyper-zillion gauss field of the kind you're trying to postulate. There's intelligence behind this, I say—maybe intelligence as far ahead of ours as your imaginary magnetic field is beyond anything we've ever measured."

The conversation petered out. In the vision screen, the stars rushed blindingly toward them, their disks streaking and changing color, and sped past. Laurance's vectors had been accurate: they were heading toward a yellowish sun that grew by gigantic bounds with each passing instant.

Onward and onward they sped. An hour of this involuntary journey had passed; a second came, went, and a third. Hernandez reported that he estimated their velocity, reckoning by observed doppler shifts, at about nine and six nines out of ten that of light. Which meant that they were travelling at virtually the ultimate speed of the normal universe — with no apparent source of velocity

It made no sense.

It continued to make no sense three hours later, when Havig awoke. The linguist sensed that something was wrong almost instantly.

"Feeling better, Havig?" Bernard asked.

"What's been going on?"

"Nothing much. You got a little upset; we had to dope you up with an ampoule of quick-sleep. Are you calmer now?"

Havig passed a quivering hand over his forehead. "Yes—yes, I'm perfectly calm. I'm trying to remember—something came over me, a fit of terror—I—I must have lost control of myself. Did I—say anything I should not have said?"

"To tell you the truth," Stone lied, "you were so incoherent we didn't know *what* you were saying. But we figured it was better to send you off to dreamland and let you sleep it off."

"Yes—thank you, thank you so much. But there's something you're keeping from me. I see it in your faces. You all look so pale, so frightened—"

As concisely as he could, Bernard explained the situation. "So we're out of control," he finished. "There's not a damned thing we can do but wait to see what's going to happen to us."

For an hour more the plunge continued, until it seemed as though it might go on forever—or until the ship vanished into the yellow sun that was its destination.

And then the Rosgollan came aboard.

Bernard's first inkling that something strange was about to happen came when he sensed a sudden glow streaming from the rear corner of the cabin, near Dominici's bunk. The strangely luminous golden-brown light filtered through the cabin. Frowning, Bernard turned to see what was causing it.

Bernard's mouth sagged open. A glowing figure had materialized in the cabin, behind Dominici's bunk. It hovered, some three or four feet off the ground.

It was a being of small stature, perhaps four feet high, poised calmly in the air. Although it wore no clothing, it was impossible to consider it naked. A garment of light enfolded it, softly streaming light that blurred the figure beneath without actually concealing it. The creature radiated not only light but an impression of total serenity, complete confidence, utmost ability.

"What—the deuce—is it?" Stone asked.

"You must not be afraid," said the visitation.

The words were not spoken aloud. They simply seemed to stream from the creature as clearly as its radiance.

Despite the quiet command, Bernard felt a sickly wave of terror sweep over him. His legs began to give way, and he sank down onto his bunk. He felt awe, reverence, and above all else a resonating chord of fear.

"You must not be afraid," the creature repeated. For an instant the light it radiated grew more intense. Bernard felt the fear lifting from him.

"What—are you?" he asked thickly.

"I am of the Rosgollans. I am your guide until we land."

It's all hallucination, Bernard thought grimly. *Even in the Greater Magellanic Cloud they don't have beings who come drifting through the walls of a spaceship and who speak perfect Terran.*

He struggled to his feet. "Dominici! Havig! Get off your knees! Can't you see it isn't real? We're having an hallucination, all four of us!"

"Do you really believe that?" the Rosgollan asked gently. There was the hint of an amused laugh. "You pitiful little creatures, so arrogantly deciding what may and may not be called *real!*"

Peals of enormous silent laughter thundered through the cabin. "We were like you, once, Earthmen—hundreds of thousands of your years ago. Eager, questing, brawling, foolish, petty little beings. We survived that stage. Perhaps you shall, too."

Stone said hesitantly, "How did you find us? Was it you that caused us to get lost?"

"No," replied the Rosgollan. "We watched you from afar, but we had no desire for contact with you. Until the moment came when we learned a ship of yours approached our galaxy. We feared, at first, that you had come seeking us—but we saw at once you were lost. I was sent to guide you to safety."

"Where—how—"

"Enough," the Rosgollan said. "The answers will come later. I will return."

The light winked out. The Rosgollan was gone.

The vision screen showed the

yellow sun swelling to cover an entire quadrant of space.

In the cabin, four men stared at each other in confusion and dismay.

Bernard began to laugh. It was a dry, thin laugh that held little mirth; the others frowned at him.

"The joke?" Dominici said.

"The joke's on us. On all of us in this cabin, and on the Norglans, and on the Technarch. Remember what Skrinri and Vortakel told us?"

"Sure," Stone said. "'*You may keep these worlds. All other worlds belong to Norgla.*'"

"That's right," Bernard said. "In cosmic pride we came to the Norglans, offering to divide the universe equally with them. In even greater pride, they sent us packing. And who were we, anyway, to say, This universe is ours? Insects! Apes!"

"We are men," Havig said stoutly.

Bernard turned on him. "*Men*," he mocked. "You talk about knowing the ways of God, Havig. What do you know? You're a worm in a puddle, and because you're the lord and master of that puddle you think you own the cosmos!"

"Hold on a minute, Bernard," Dominici protested. "Is it *your* turn to go nuts now? What are you trying to tell us, anyway?"

In a quiet voice Bernard said, "I'm not really sure—yet. But I think we're going to be put into our true slot in the order of things. *We're* not lords of creation; we're hardly even civilized, in the eyes of these people. Did you hear what the Rosgollan said? They were like us, *a few hundred thousand years ago!*"

"All right, so they're greatly advanced—"

"Greatly?" Bernard shrugged. "The difference is inconceivable. It knocks some of the arrogance out of you, doesn't it, to find out that you're not really king of the heap?"

"Earth will be in for some surprises, if we ever get back," Havig remarked.

"Surprises enough to upset the applecart with a crash," Bernard said. "We had it too good too long. It was bad enough finding the Norglans cluttering up our nice universe—but now to run into *these* people—"

"And who knows what others there might be?" Stone said suddenly. "In Andromeda, in the other galaxies? Creatures far beyond even the Rosgollans—"

It was a numbing thought. Bernard looked away, feeling a kind of dizziness at the sudden revelation of the universe's immensity.

They made their way fore. But there was no need to tell Laurance. The crewmen were sitting in their cramped cabin looking dazed and shaken.

"You saw it too?" Dominici asked.

"The Rosgollan?" Laurance said. "Yes. Yes, we saw it too." His voice was utterly flat.

"We can't let this crack us up!" Bernard said.

"Why not?" Laurance asked tonelessly. "It's the end, isn't it? The finish for all our big talk of galactic empires? Now we know just how insignificant we are. Just the mammals who happen to live on a certain little yellow sun in that little galaxy there on the screen."

Bernard did not reply. He stared at the master screen in the control panel A planet hung large in the visual focus. The *XV-ft1* had drifted into an orbit round it, an ever-narrowing orbit.

"We're landing," Bernard said.

CHAPTER 13

THE scene that lay before the Earthmen, as they left the ship—which had floated down, feather-light, in defiance of all laws of inertia and mass—was one of pastoral serenity.

Gentle green hills rolled out to the horizon. Dotting the green here and there were the pastel tones of small houses that seemed to sprout as organically from the ground as the low, stubby trees. There was no sign of industry, none of transportation.

"Just like fairyland," Dominici said softly.

"Or like Paradise," murmured Havig.

Bernard said, "It's the post-technological phase of civilization. Remember the withering-away of the state that the ancient Marxists were forever trumpeting about? Well, this is it, I'm sure."

The nine of them stood together not far from the ship, waiting for a Rosgollan to put in an appearance. The air was sharp, with an alien tang to it, but it felt good to the lungs. A coolish breeze blew in from the hills.

Just when they were beginning to grow impatient, a Rosgollan appeared, winking into view out of nowhere between one instant and the neat.

It was impossible to tell whether the Rosgollan was the same one that had come to them aboard the ship. This was about of a size with that other, but its features and body were partially concealed by the blur of light that attended these people wherever they went.

"We shall go to the others," said the Rosgollan in its soft unspeaking voice.

The golden glow suddenly enswaddled them all; Bernard felt a moment of womblike warmth, and then the light dropped away, and the ship vanished.

They were inside one of the alien houses. The Rosgollan said, "Be comfortable. The interrogation is about to begin."

"Interrogation?" Laurance asked. "What kind of interrogation?"

"You will come to no harm, Commander Laurance"

Bernard tugged at Laurance's arm "Better just relax and take things as they come," he whispered. "Arguing with these people won't do a bit of good."

The Earthmen made themselves comfortable. There was no furniture in the room, only soft red cushions, on which they sat.

In a moment, in the twinkling of an eye, there were three more Rosgollans in the room. Looking from one to the next, Bernard could see no discernible difference; they were as identical as though all had been stamped from the same mold.

"The interrogation will now begin," came the serene word from one (or was it all?) of them.

"Don't answer a thing!" Laurance snapped suddenly. "We don't want to give them any vital information. Remember, we're prisoners here, no matter how well they happen to treat us!"

Despite Laurance's outburst, the interrogation began. There was nothing Laurance could do to prevent it. Not a word was spoken, not even in their peculiar mental voice; but, beyond doubt, there was a flow of information.

The interrogation seemed to last only an instant, though Bernard was not sure: perhaps it took hours, but the hours were shrunken to a point in time. He could not tell. But he felt the outflow of information.

The four Rosgollans drew everything from him: his childhood, his disastrous first marriage, his academic career, his interests and crochets, his second marriage, his unlamented divorce. All this they took from him in an instant, examined, discarded as being personal and therefore of only incidental interest.

In the next layer they drew from him the summons from the Technarch, the journey to the Norglan colony, the unsatisfactory meeting with the Norglans, the bungled voyage home. They knew everything to date.

Then it was over. The tendril of thought the Rosgollans had inserted into the brains of the Earthmen snapped back. Bernard blinked, stunned a little by the snapping of the contact. He felt drained, hollow, exhausted. He felt as though his brain had been drawn forth, examined very carefully, and put back into place.

And the Rosgollans were laughing.

There was no sound in the room, and, as ever, the faces of the strange beings were veiled in impenetrable light. But the *impression* of laughter hung in the air. Bernard felt his face grow red, without quite knowing why he felt shame. There had been nothing in his mind of which he was ashamed. He had lived his life, sought the ends he thought desirable, cheated no man, wronged no one intentionally. But the Rosgollans were laughing.

Laughing at me, he wondered? *Or at someone else here? Or at all of us, at all the human race?*

The unheard laughter died away.

"You're laughing at us!" Laurance cried belligerently. "Laughing, you damned superior beings!"

The alien reply was gentle. "Yes, we are amused. We ask your forgiveness, Earthmen, but we are amused!"

Bernard realized that these Rosgollans were not quite the noble and mature beings he had been regarding them as. They could laugh at the struggles of a younger race. It was a patronizing laugh.

"We will leave you alone a while," the Rosgollans said. The light vanished.

"So that's what it's like to be interrogated," Dominici said. "I could feel them prowling around in my head—and I couldn't shut them out. Imagine it—fingers stroking your bare brain!" He shuddered at the memory.

"Why are they doing all this?" Hernandez demanded. "Why did they have to drag us down here and toy with us? What's their purpose?"

"More important," said Dominici. "How are we going to get out of here?"

"We aren't," said Bernard in a flat voice. "Not unless the Rosgollans decide to let us go."

"You're turning into a defeatist, Bernard," Dominici said warningly.

"I'm just looking at things realistically. How are we going to escape? Where's the ship? What did they do with it?"

"Why—uh—" Dominici paused. He walked to the door of the room. The door obediently drew back as he approached, and he stepped out, into the open. The others followed him out.

Green hills rolled to the horizon. Fleecy clouds broke the harsh metallic blueness of the sky.

There was no sign of the ship

"We might be anywhere on this planet," Bernard said "Five, ten, fifteen thousand miles from the ship. How are we going to get back? By transmat? Teleportation? On foot? Which direction do we go?"

"So we're prisoners, then," Dominici said bitterly.

"Even if we reached the ship," said Havig, "they would only bring us back, the way they brought us here originally. We are at their mercy."

Bernard kneeled in the meadow just outside the building He snatched up a stalk of grass with a snapping motion of his hand. It was a painful business, this being gently wafted to Rosgolla It struck at the center of a man's soul to keep him in this sort of smiling bondage.

"Hey!" Dominici exclaimed "Food!"

Bernard turned. He caught a glimpse of a dying light, and, spread out on the grass in front of the house, he saw trays of food.

"We might as well dig in," he

said. "The worst it can do is kill us."

He picked up a small golden cake and nibbled it experimentally. It literally melted in his mouth, flowing down his gullet like honey. He ate another, then turned his attention to blue gourd-like vegetables, to a crystal pitcher of clear yellow wine, to round translucent white fruits the size of cherries. It was all delicious, and it was impossible to suggest that such delicate foods might be poisonous to a Terran metabolism. He ate his fill.

The sun was dropping in the heavens now. Near the horizon a small moon could be seen, low in the late-afternoon sky, visible as a tiny flat pearl against the darkening blue. It was a scene of simple beauty, as the meal had been simple, as the few Rosgollan buildings he had seen were simple. That simplicity alone argued for the great antiquity of these people. They had gone past the cultural stage of finding virtue in size and complexity, into the serene mature era of clean lines and uncluttered horizons.

He could find pleasure in such a life, he who had enjoyed solitude and quiet, the peace of a fishing preserve on a young colony, the privacy of his own flat in London, the silence of his study-retreat in the Syrtis Major.

"What do they want with us?" Hernandez was asking.

"We amuse them," Laurance said. "Maybe they'll grow tired of us sooner or later, and let us go."

"Let us go where?" Nakamura said quizzically. "We are more than one hundred thousand light-years from home. Or will the Rosgollans show us how to find our way back, when they let us go?"

"*If* they let us go," Dominici corrected.

"They won't keep us here long," Bernard said, breaking his long silence.

"Oh? How do *you* know?"

"Because we don't fit into the scheme of things here," the sociologist replied. "We're blotches on the landscape. The Rosgollans have their own tranquil lives to lead. Why should they install a bunch of barbarians on their quiet planet to stir things up? No, they'll let us go when they're through with us. They aren't the zookeeper type."

The night was falling rapidly now.

They went inside and some of the men settled themselves on the cushions as if settling down for the night. Bernard walked to the edge of the single room, leaned against the wall, and watched it turn transparent for three feet on either side of him to provide him with a window.

He peered outward, upward. The strange stars blazed down. He sought for Earth's galaxy, but it did not seem to be visible from this part of the planet. Feeling suddenly stifled by the magnitude of his distance from home, Bernard reeled away from the window and threw himself down on the nearest cushion. He jammed his eyes tightly together. His lips moved as if of their own accord.

He recovered his self-control after an instant and thought in quiet wonder, *I prayed! By the Hammer, I actually prayed to go home!*

The prayer had been like a release. The knot of tension that had been forming for hours within him let go its hold. He cradled his head on his folded arms, kicked off his shoes, and was asleep within seconds.

CHAPTER 14

MORNING came swiftly. Bernard woke, feeling cramped and musty from having slept fully dressed, and rose to a sitting position. The others were strewn around the floor, still asleep, and the room was still dark.

Stepping through the obliging door, Bernard sucked in his breath sharply; the air was marvelously fresh, the distant hills looked new-minted in the transparent morning sky, a silvery sheen of dew glistened over the meadow. For an instant Bernard almost forgot where he was and how he had come to be here.

One by one the others came out, stretching their legs after the short night. Stone joined them first, then Nakamura with his cheery greeting, then Havig, nodding brusquely, and Laurance, lost in his own private bitterness. After him came Clive and Hernandez, with the taciturn Peterszoon strolling out last and glaring at the group as if each, personally, were responsible for his predicament.

"Any sign of breakfast?" Stone asked.

"Not yet," answered Bernard. "Maybe they were waiting until we were all awake."

"Look there!" Clive cried suddenly. "*Look!*"

Eight heads turned to look.

"No," Bernard gasped. "It isn't so. It's a hoax—an illusion—"

For an instant, a nimbus of radiance had settled lightly to the meadow some fifty yards from the group of Earthmen. The light had glimmered briefly, then flickered out. And in the afterimage of the light, two burly figures could be seen—two massive dark-skinned figures, not precisely human, that staggered uncertainly over the grass, looking all about them in bewilderment and—perhaps—fear.

Skrinri and Vortakel. The *kharvish*. The haughty Norglan diplomats.

"We have brought you companions," said a Rosgollan voice. "The negotiations may now proceed once more."

The big Norglans looked drunk, or else just badly disorientated. But they recovered swiftly; and then all their recovery went to nought as they recoiled in astonishment upon catching sight of the Earthmen.

"Are they the same ones as—before?" Dominici asked.

"I'm sure of it. See, the bigger one is Skrinri, the one with the scar on his shoulder is Vortakel."

The Norglans drew near. In a tone that was harsh, guttural, quite unlike his mellow boom of old, Skrinri said, "You—Earthmen? The same Earthmen?"

Bernard answered, "Yes. We have met before with you. You are Skrinri—you, Vortakel."

"Where are we?" Skrinri asked.

"Far from home," Bernard said. He groped for the words; how to explain the concepts "galaxy," "parsec," "universe"? He abandoned the effort. "So far from home," he said after a moment, "that neither your sun nor ours can be seen in the sky."

The Norglans spoke to each other, for a long while, in their own consonant-studded, vastly involuted language.

Bernard pitied them. If anything, the Norglans had a higher opinion of themselves and their relation to the universe at large than any of the Earthmen had; and it had been crushing enough to the Terran ego to discover that such a race as the Rosgollans existed. How much more agonizing it must be, he wondered, for the Norglans to discover that they could be plucked from their planet and hurled incalculable distances across the sky by strange glowing beings of another galaxy?

He became aware that Rosgollans were returning. Like fireflies they glimmered on the horizon, flickering into existence all about.

A silent Rosgollan voice said, "We have interrogated the Norglans while they journeyed here. We learn from them that they hold it is their manifest destiny to conquer all the universe. While you Earthmen have something of the same belief. Obviously, one side or the other must give ground or there can be no peace between you. You must reach a mutual decision."

Skrinri growled — evidently the Rosgollan's words had been intelligible to the Norglans as well as the Earthmen— "We have been fair to the Terrans. We permit them to keep their own worlds. But the other planets—these must be ours."

"By whose grant?" asked the Rosgollan with a trace of mockery. "At whose behest do you take possession of all the worlds there are?"

"At our own!" rumbled the Norglan, getting some of his self-confidence back. "The worlds are there; we reach them; we take them. What greater authority do we need than our own strength?"

"None," replied the Rosgollan. "But your own strength is insufficient. Weak, arrogant, blustering creatures you are, nothing more. I speak now to

both participants in this dispute."

Skrinri and Vortakel seemed to curdle with rage. "We do not speak more! Return us to our world or we shall take steps! Imperial Norgla does not tolerate this manner of abuse. We—"

Vortakel's voice died away in sudden confusion. He and Skrinri had risen from the ground during their outburst; now they hovered, better than a yard above the grasstops, kicking their feet in rage and frustration.

"Put us down!" Skrinri howled.

"Show us your strength now, men of Imperial Norgla," came the dry murmur of the Rosgollan spokesman. "You do not tolerate levitation? Very well; force us to stop."

Double-elbowed purple arms flailed the air. The Norglans rose, inch by inch; now they were more than their own height above the ground.

"Put — us — *down!*" Skrinri grunted.

"Very well."

The Norglans dropped suddenly, much to their great surprise. They landed in an undignified heap; when they rose, it was slowly, with bowed heads, and they did not look at the Earthmen.

"We have taken you from your home world," the Rosgollans said, "and we have shown you the extent of your strength. And still you claim the universe is yours?"

The Norglans made no reply.

The Rosgollan voice continued, "And there, the Earthmen, creatures less sure of themselves, but equally proud, equally greedy. You would divide the universe with the Norglans, we learn. But does it lie in your hands to make such an apportionment?"

For a long moment no Earthman dared to speak. It was futile to trumpet of strength, in the teeth of beings who held powers beyond comprehension.

But something had to be said. Some justification had to be made.

"We acted in no sense of pride," Bernard said quietly. "We are a growing race; we sought room to expand. The Norglans, like us, must expand. Our hope was to reach an agreement that would prevent a conflict of interests, something that would be of benefit to both races."

"You laid claim to half the universe," the Rosgollan voice said accusingly. "Where is the humility in this?"

"We laid claim to half the universe, yes—thinking the universe held no peopla but Terran and Norglan. *There* lay our pride, in that blind assumption. We were wrong. There are other races in the universe, and of all the races we are the youngest, and therefore the most foolish. But we still claim the right to expand and colonize worlds which now lay empty."

Bernard felt waves of ironic laughter sweep down from the circling jury of Rosgollans.

"The Earthmen reduce their claim," commented the Rosgollan voice sardonically. "Instead of half the universe, now they simply demand half the uninhabited worlds. It is a major concession, I suppose. What of you, proud men of Imperial Norgla —speak for your people. Will you, too, reduce your claim?"

The Norglans did not hurry to reply. At length Vortakel said, "You have shown us that—perhaps—we are not—the strongest people of the universe. We cannot fight you. Therefore we yield."

For a frozen moment no one moved: the slump-shouldered Norglans standing at each other's side like beleaguered Vikings, the Earthmen huddled in their little group some twenty feet away, the ringing circle of Rosgollans.

"Just one moment!" Laurance cried suddenly. "You've brought us all here, somehow, these Norglans and us, and you're holding a little kangaroo court here. Fine. You have powers we don't have, and you've shown them off beautifully. But what right do you have to meddle inside our galaxy? Who set you up as our judge, in the first place? Is it just the right of might?"

"We are not judging," replied the Rosgollan voice levelly. "We are mediating a dispute between two races. Two *young* races. In order to mediate successfully we must demonstrate our strength. It is the only way to deal with children."

"With—"

"*Children*, yes. Life has come late to your galaxy. As yet, only two intelligent races have evolved there—energetic, vigorous races. For the first time the paths of these young races have crossed. Your fledgling empires soon would be at war without our mediation. We take it upon ourselves, therefore—acting in the interest of the races of the universe, of which we are neither the oldest nor the most powerful—to prevent this war.

"Therefore limits will be drawn for the empire of Earth, and limits for the empire of Norgla. You shall not exceed these bounds in your search for colonies. And in this way your galaxy shall live in peace."

CHAPTER 15

IT WAS done. And, though the Archonate knew nothing of the treaty, everyone of the nine Earthmen realized that what they had done was irrevocable.

Through some magic of their own, the Rosgollans had conjured up, out there in the meadow, a scale model of the island universe that contained Earth and Norgla. It drifted in midair, a spiral with two curving, snakelike arms, composed of millions and millions of glowing points of light.

Suddenly, springing up within the galactic model, a line of green light picked out a sphere perhaps a foot in diameter.

"This is the Terran sphere of dominion," a Rosgollan voice silently informed.

An instant later a second sphere sprang into glowing life, this one red, of virtually the same size, and located halfway across the model.

"This is the Norglan sphere of dominion," came the Rosgollan admonition.

A searingly bright line of fierce violet zigzagged out across the model, dividing it from rim to core, lancing between the tight-packed stars to partition the galaxy into two roughly equal segments.

Colors began to spread all across the model, the green light filling all the Terran half, the red streaming over all the Norglan suns. The Rosgollan said, "These shall be the everlasting boundaries of your dominions. Crossing them for any reason will bring immediate retribution from beyond your galaxy."

"We have no right to enter into a binding agreement without informing our government," Stone protested stammeringly.

"The arrangement will be binding," replied the Rosgollan. "Formal consent of high officials will not be necessary. This is not a treaty! It is an imposition from without. You will obey the establishment of the boundary line."

The Norglans looked agitated. Skrinri declared, "You—order us to obey?"

"Yes. We order you. These are the boundaries. You will keep within them; and you will cease to threaten each other with war, in the name of galactic harmony. Is that understood?"

Eleven figures stared dumbly at the model and at the eerie creatures that had created it.

"*Is that understood?*" demanded the Rosgollan again, with some acerbity.

Martin Bernard shrugged and said quietly, "Yes. We understand."

"We understand," Skrinri echoed.

"It is done, then." The divided model winked out.

Light swirled about the heavy figures of the Norglans, and immediately they were gone. An instant later, most of the Rosgollans had vanished. The Earthmen felt warm light engulf them —and then they stood just outside their ship once again.

"Enter it," a Rosgollan voice commanded gently. "We will restore you to the galaxy in which you belong."

The Earthmen, silent, shamefaced, clambered into the ship. Peterszoon, the last man aboard, activated the hatch controls, swinging the entry gate shut and dogging it tightly closed.

The ship lifted almost immediately, without any sensation of blasting off. It simply detached itself from the ground and floated spaceward.

"So that's that," Stone muttered bitterly. "We've got quite a story to tell when we get home! We encountered *two* alien races, and one kicked us around a little harder than the other."

Stone said darkly, "So we set out from Earth as the universe's dominant race, and come back home policed into one corner of our own galaxy. That isn't going to be easy for the Archonate to swallow."

"It won't be easy for anyone to swallow," Bernard replied. "But the truth never is. We *aren't* the universe's dominant race; not yet, anyway. The Rosgollans and maybe some others have an evolutionary head start of maybe half a million years on us. So we've been put in our place—for a while."

"This is the greatest defeat Earth has suffered in her history," Stone persisted.

"Defeat?" Bernard snorted. "Do you call it a defeat if you slam your hand against a metal bulkhead and break your fingers? Sure, the bulkhead defeated your hand. It'll do it every time. It's in the nature of metal bulkheads to be stronger than fingers, and it's ridiculous to moan about the philosophical aspects of the situation. In the same way, it's in the nature of highly advanced races half a million years older than we are to be more powerful than we are. Why get upset about it?"

"Bernard is right," Hnvig said. "The great wheel of life keeps turning. Some day the Rosgollans will be gone, and we, in the twilight of our days, will watch other, younger, stronger races come brawling across the skies. And what will we do then? Just what the Rosgollans did to us: confine those races, for the sake of our own peace."

Sinking his head in his hands, Stone muttered, "It all makes perfectly good sense on the abstract, intellectual level. But come down to realities. How do you tell a planet that thought it was the tops that it's very small potatoes indeed?"

"That's the Archonate's problem," Dominici said.

"What does it matter *whose* problem it is?" Stone demanded. "It's a planetary humiliation."

"It's a planetary eye-opening," Bernard snapped. "For the first time we have some other races to measure ourselves against. We know that the Norglans are just about as good as we are, right now—and that the Rosgollans are a whole lot better. So we know we have to progress, to keep abreast of the Norglans, to aim toward the level of the Rosgollans. And we'll get there."

Hernandez entered the cabin. "Commander Laurance sent me back to let you know that the Rosgollans have returned us to the place where we got lost, and we're about to convert into nospace and head for home."

Dominici gasped. "You mean we're back in our own galaxy so fast? But—"

"That's right," Hernandez said quietly. "It's only half an hour or so since we left Rosgolla. But we've come back. There's no doubt about it."

As the spaceman left, Bernard felt a tremor of awe. They had crossed the galactic gulf in twenty or thirty minutes, thanks to the Rosgollan boost. It was a feat beyond the capacity of the mind to grasp. But, he realized, it was only to be expected of a race as advanced as the Rosgollans. *Where were we half a million years ago?* he wondered. *Pounding our hairy chests, brachiating through the trees, cooking our uncles for dinner, maybe even eating them raw if cooking hadn't been invented yet. And we came from Pithecanthropus to the transmat era in half a million years—picking up speed as we came. Who's to say where we'll be half a million years from now?*

The thought was warm, comforting. For the first time since the journey had begun, back in the wastes of Central Australia, Bernard felt a moment of certainty, of understanding man's relation to the universe about him.

CHAPTER 16

THE private chamber of the Technarch McKenzie had a harsh, almost hieratic simplicity, with its black stone walls and its bright, shimmering marble floor. The windowless chamber had been designed to impress both its occupant and his visitors with the somber importance of the Technarch's post. Bernard felt a tinge of something quite like awe as he followed McKenzie in.

Dominici, Stone, and Hnvig waited in the Technarch's antechamber, while Bernard, alone, faced McKenzie.

The Technarch slipped into his seat behind his broad, bare-topped desk and gestured to Bernard to sit facing him. Glad to get off his shaky legs, Bernard took the seat. He stared levelly at the Technarch's face and took a deep breath.

Bernard said, "I'll begin at the beginning, Excellency."

"An excellent idea."

In a calm voice Bernard said, "We had no technical difficulties in reaching the planet of the alien colony. We landed, observed the aliens for a while, and finally made ourselves known to them. They call themselves Norglans. We made it clear to them that we had come to negotiate a treaty, whereupon our Norglan contact left us and returned, some time later, with two of his superiors."

"What did they say?" McKenzie asked.

Bernard leaned forward. "We explained quite clearly to them that it was inevitable that the boundaries of our respective spheres of expansion were bound to overlap and clash, and we showed them that it was Earth's wish to arrive at a peaceful settlement *now*, rather than let matters slide until the actual collision came, and with it war."

"Yes? And how did they react?"

"They listened to what we had to say, and then they presented a counter-proposal: that Earth confine itself to the worlds already colonized, leaving all the rest for Norgla."

"*What?*" Fury blazed in the Technarch's eyes "Of all the preposterous nonsense! You mean they simply told you to agree to an end of all Terran expansion? That we abdicate as a galactic power?"

Bernard nodded. "That was precisely the way they put it. The galaxy was theirs; we would be allowed to keep the worlds we had already taken, but no more."

"And you rejected this insanity, of course."

"We didn't get the chance to. The two Norglan ambassadors hurled their ultimatum and walked out—went back to their home planet. We protested to the colony supervisor, but he said he could do nothing. So we blasted off for Earth."

McKenzie goggled incredulously. Spots of color appeared on his cheeks; his nostrils widened in suppressed rage. "You realize what this ultimatum means. We're at war with these creatures after all, despite everything—"

Bernard held up one hand, fighting to keep it steady. "Your pardon, Excellency. I haven't finished."

"There's more?"

"Much more. You see, we became lost trying to return home. Commander Laurance and his men spent hours trying to get us back on course, but there was nothing they could do. We emerged from nospace, finally, in the region of the Greater Magellanic Cloud." Bernard felt a band of tightness in his stomach. The words rolled glibly from his lips, though he knew each one drove a maddening wedge deep into the Technarch's mind. "We were lost, fifty thousand parsecs from Earth, and no way of returning. But suddenly our ship was taken over by an irresistible force. We were drawn down to a planet in the Magellanic Cloud, inhabited by beings that identified themselves as the Rosgollans. Strange beings—with wonderful mental powers. They—read our minds, found out about our mission to the Norglans. And then—then they brought the two Norglan ambassadors across space to meet with us again."

The Technarch's facial expression had been changing all during Bernard's last few sentences. Now McKenzie seemed to be staring silently off into a void, face growing pale, eyes glazed and reflective.

"Go on," the Technarch said in a terribly quiet voice.

"The Rosgollans staged a kind of courtroom scene—and after it was over they divided the galaxy into Terran and Norglan spheres."

"Divided it?"

"Yes. Here—I have the chart on a flat projection. It's a line that runs right through the heart of our galaxy. Everything on this side is ours; everything on the other side, Norglan. And if either side crosses the boundary line, or if we leave the confines of our galaxy, the Rosgollan scouts will discover it and administer punishment."

The Technarch took the starchart from Bernard with a leaden hand, looked at it for an instant, shoved it roughly to one side. He seemed to sigh.

"You aren't—making all this up, Bernard?"

"No, Excellency. It's all true. The Rosgollans are out there, half a million years cleverer than we are—and they hinted that there were other races even more powerful, in the distant reaches of the universe."

"And we have to keep in line—like small boys in school—Norglans over here, Terrans over there—while the Rosgollans make sure we don't get out of step. Is that it?" The Technarch's face became a mask of rigid anguish.

Something shattered inside the Technarch. His shoulders seemed to slump; his face sagged, the wide mouth drooped, the massive forearms lost their strength and dangled limply. Bernard stared at the floor. Watching McKenzie break in this instant was like watching a monument tumble to destruction; it was painful to see.

When McKenzie spoke again, it was in a different voice, with none of the metallic inner strength of his Technarch tone. "I guess this expedition didn't work out so well, then. I sent you out as representatives of the finest race in the galaxy—and you come back defeated—*crushed*—"

"Excellency—"

"So all my dreams are over. I thought in my lifetime I'd see Terrans ranging the farthest reaches of the universe—and instead we're hemmed into half a galaxy, by the mercy of our masters. And that's the end, isn't it, Bernard? Once a limit has been set, once someone puts a fence around us—that ends all our dreams of infinity."

"No, Excellency! That's where you're wrong! I admit we aren't in the same position of supremacy we were in before Laurance discovered the Norglans—*but we never were in that position of supremacy!* We never were the lords of creation. It only *seemed* that way, because we'd never come across any other race.

"We're too young, too new, to have the kind of power we thought we had. There are the Norglans in our own galaxy, just as strong as we are, probably. And outside the galaxy the Rosgollans, and who knows what greater races than those? But now we have something definite to work for. We have finite goals instead of vague, indefinite ones. We know we have to work to evolve past the Norglans, toward the Rosgollans. When we're in *their* class, we'll legitimately be able to hold our heads up in pride.

"The Rosgollan boundary will guarantee that we don't bite off more than we can chew, Excellency. But we've got all the future ahead of us. Tomorrow belongs to *us*. We've had a setback, maybe, but it isn't really a setback—just an end to our complacency, a beginning of the realization that we're not the be-all and end-all of creation. That we still have a long way to go. So that's why we can't let this throw us, Technarch McKenzie."

In a muffled, hollow voice, McKenzie said, "Maybe—maybe you're right, Bernard. I wanted to forge Man's empire in the stars. With these hands, I wanted to build it."

"We haven't lost that hope, Excellency."

"No. *We* haven't. But *I* have."

A sob racked the Technarch's body. Bernard looked around helplessly. There was nothing he could say, no word of sympathy, nothing to be done for this man whose dreams of empire-building had tumbled so quickly into the dust. The Technarch's lips moved wordlessly. Finally he said, "All right, Bernard. Put the report in writing. Don't gloss anything over."

"Yes, Excellency. Is there anything else?"

A pause. Then: "Get out of here. Leave me alone. Tell Naylor I won't be seeing anyone else today. *Get out of here!*" His voice trembled.

A lump of pity clogged Bernard's throat as he bowed to the Technarch, still a formidable figure in his black cloak of office. Then, unable to bear the sight, Bernard turned and rushed away, through the irising sphincter into the antechamber, and to the transmat that sent him home.

Everything was as he had left it. Everything seemed to be waiting for him—the books, the pipe, the music, the brandy—waiting for him to slip back into his life at the point where he had stepped out of it. But it would never be the same again, Bernard thought.

Never the same again for any of us. He walked to the window, looking out past the foggy London night to the faint glimmering stars that managed to make their way through the haze.

THE END

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FACT

YARDSTICKS IN SPACE

By
BEN BOVA

Everyone knows that Alpha Centauri is 4.3 lightyears distant from Earth. But how do we know we know it. Here expert Ben Bova summarizes the state of our ability to measure the Cosmos—and predicts future possibilities.

THE Greeks certainly had the words for it, but it was a canny Italian who thought of using numbers and turned ancient philosophy into pragmatic science. Perhaps Galileo's greatest contribution to human thought was his insistence on measurement. Idle speculation ends when you bring a yardstick into the argument.

Measurement is the heart of science. In astronomy, distance measurements are the foundation upon which rests almost all our knowledge. For example: An astronomer sees a star in the night sky and notes its apparent brightness. But how much light is the star actually putting out, what is its intrinsic luminosity? This cannot be determined until the distance to the star is known. And unless the star's real luminosity is known, not even the greatest astronomer can learn anything about the star's evolutionary history.

Before suitable distance measurements could be made, for instance, it was impossible to decide if the great spiral nebulae (such as the one in Andromeda) were clouds within our own Milky Way galaxy or were distant galaxies in their own right. Even today, our knowledge of the size and age of the universe itself depends on the yardsticks used to measure the distances of the farthest galaxies.

How can you measure the distance to a star, or to the farthest reaches of the known universe? You begin with a triangle.

George Washington knew how to measure the distance to an object he couldn't touch. He could measure the width of a river with his surveyor's baseline and telescope. First he would measure out a baseline. Then he would sight an object on the farther riverbank—a tree, perhaps—from each end of the baseline, and measure the angles formed by the ends of the baseline and the tree. Thus George could construct on paper a triangle in which he knew the length of the base, and the size of two of the three angles. Simple trigonometry would tell him the length of the other two legs of the triangle, or the length of a line drawn from the tree perpendicular to the baseline—said line being the actual width of the river, or very nearly.

Interplanetary Distances

If Washington had been inclined toward astronomy rather than politics, he could probably have made accurate measurements of the distances to the Moon and the planets. For these problems, astronomers simply use longer baselines—hundreds, even thousands, of miles long. This is necessary because they are dealing with distances literally out of this world. The longer the baseline, the larger and more easily-measured are the angles formed at each end of the base with the target.

But there are two other ways to get interplanetary distances, both of them rather slick when compared to the exacting triangulation method. First is the geometric method. With it, it is not too difficult to draw a map of the solar system even if none of the distances between planets are known. This may sound odd, but it's been done for centuries. All the orbits of the major planets and their satellites can be plotted quite nicely, without knowing any distances at all. For example: Venus is never seen more than 45° away from the Sun. You can draw a circle of any size to represent the Earth's orbit, with the Sun as the center. Pick a spot on the circle to represent the Earth's position, and connect the Earth and Sun with a line. Measure off 45° angles both above and below the line. Draw a circle inside the 90° angle thus formed, with its center on the Sun. That's the orbit of Venus. If you measure the circles, you'll find that Venus' orbit is about 0.7 times the radius of Earth's orbit. You don't have any idea of the miles or kilometers involved, but you do have the *geometric relationship* between the two planets.

The same tactics can be applied to every planet, giving a fine map of the solar system. But it is a map without a scale. To get the scale, at least one distance has to be measured. Once a single measurement is made, though, *all* the distances fall neatly into place.

The standard unit of distance for solar system work is the Astronomical Unit. It is defined as the mean distance between the Earth and Sun. Measuring the distance to the Sun directly, to determine the Astronomical Unit (or AU), is a difficult proposition. The Sun's glare, and the lack of permanent markings to serve as a target for the measurement, cause grave complications. So the AU is usually measured indirectly, by the geometrical relationship technique. (In 1931 astronomers all over the world cooperated in measuring the distance and orbit of the planetoid Eros, which spiralled to within nearly 15 million miles of Earth. With Eros' orbit firmly known, and its distance at any given time established, the whole scale of the solar system—and the value of the AU—gained a new precision.)

Since 1950 radar has taken an important role in determining distances to the nearer planets. Both the U.S. and Russia have made radar measurements of Venus' distance, and refined the definition of the AU down to 92,956,200 ± 200 miles (as of 1962). In 1963 a group of MIT researchers bounced a laser beam off the Moon. Laser measurements, using visible light instead of longer-wavelength radar or radio waves, hold the promise of even more accurate measurements.

Parallax: the Long Triangle

The triangulation system that works so well within the solar system is also used for the stars. But here its success is limited. Indeed, although the possibilities of triangulation measurements for stellar distances have been known since Copernicus' time, it was not until 1838 that Friedrich Wilhelm Bessell of Prussia made the first successful measurement. The reason is simple: sheer distance. No baseline on Earth is long enough for stellar distance measurements. But astronomers are an ingenious lot, and have turned to an astronomical baseline: the diameter of the Earth's orbit around the Sun, which is some 186 million miles long.

But even it is barely long enough. The technique for stellar triangulation is to observe the star at six-month intervals—that is, from opposite ends of the baseline. Hopefully the target star will show a slight shift of position in reference to the other stars around it. This depends on the target star being near enough to show a measurable shift, and the background stars being far enough to remain fixed in position. Many an astronomer has spent a couple of heartbreaking years trying to measure the distance to a star that was just too far away to show any shift at all.

The "slight shift" of the star's position is called the *parallactic* shift. You can produce a parallactic shift for yourself by holding your thumb up at arms length and squinting at it with one eye at a time. Your thumb will seem to move in relation to the background you see it against. The word parallax is of Greek origin, meaning "the mutual inclination of two lines forming an angle." (The Greeks really did have a word for everything!)

The parallactic shift measured by Bessell was for the star 61 Cygni, which shows a shift of 0.294 second of arc. One second of arc is about the size of a twenty-five cent piece, seen from three miles away. The distance of 61 Cygni is 11.1 lightyears. The distance to Alpha Centauri wasn't measured until respectable telescopes were set up in the southern hemisphere. Alpha Centauri's parallactic shift is 0.76 second of arc—corresponding to a distance of 4.3 lightyears. Bessell's measurement, incidentally, is comparable to measuring an 11-mile distance from a baseline of one inch. Quite a trick!

Parallactic shifts are time-consuming and tedious, but they are the only direct method of measuring a star's distance. And "direct" is a relative term; the whole system depends on the accuracy of the Astronomical Unit, which is why astronomers are always trying to refine their estimates of the AU. Worse still, the trigonometric parallax method works for only a handful of the very nearest stars: only a few hundred of the 100 billion stars in the Milky Way. Astronomers are thus almost in the position of a man who can measure only those objects within the span of his arms!

But not quite.

Although direct measurements for stars greater than about 100 lightyears away are now impossible, astronomers have several other tricks up their sleeves. For example: the Sun is boring through space at the rate of 4.2 AU each year, dragging the Earth and the rest of the solar system along with it. Each year, then, the Earth travels twice the span of its 2-AU orbital diameter. Moreover, this 4.2-AU annual baseline grows with time; in 10 years, it's 42 AU. Astronomers have used this type of baseline

to estimate the distances to large groups of stars.

The system won't work for a single star, because it, too, is moving across the sky in its own orbit. It refuses to stand still while we measure it. For a large sampling of stars, though, astronomers can assume that the individual motion of any one star is cancelled out by an opposite motion of another star in the group. By picking out a large sampling of stars that all have the same apparent brightness and color (and hence would probably be at approximately the same distance from us) a *mean parallax* value can be measured, and the average distance to the entire group established reasonably well.

Mileposts in the Sky

IT wasn't until the twentieth century that astronomers realized there were actual mileposts in the heavens waiting for man to make use of them. Not that there was anything subtle about the mileposts: they blaze with the light of a thousand Suns, and even wink on and off! The mileposts are certain types of variable stars, called Cepheid variables and RR Lyrae variables, after the cryptic astronomical jargon.

RR Lyrae stars are strictly telescopic objects. But Delta Cephei, the prototype Cepheid variable, can be seen by the unaided eye as a fourth-magnitude star in the constellation Cepheus, between Cassiopeia and Cygnus. A more prominent Cepheid is Polaris, the North Star. But don't expect to see any changes in brightness without some professional equipment. Polaris fluctuates about a tenth of a magnitude every four nights: a glaring phenomenon for the astronomers, but impossible to detect with the naked eye.

There are many types of variable stars in the heavens, but what makes the Cepheids and RR Lyrae stars important is the extreme regularity of their brightness fluctuations. The time interval between one peak of brightness and the next is precisely the same for any given star of this type. The American astronomer Edward Barnard claimed that if all the clocks on Earth stopped he could tell time by a certain Cepheid variable he had studied for years, so exact was its pulsation period. Both the Cepheids and the RR Lyrae stars are very luminous stars, and can therefore be seen over truly immense distances. The Cepheids tend to be the brighter, averaging several thousand times the Sun's luminosity. The pulsation period of Cepheids run from several days to several weeks; periods of the RR Lyrae variables are usually under one day.

What has all this to do with distance measurements?

Well, if you can determine a star's actual brightness—its intrinsic luminosity—and then compare it to its apparent brightness as seen from Earth, you can determine its distance. The difference between apparent and actual brightness depends on the distance. However, for most stars the actual luminosity can only be determined once the distance is known. Thus: impasse. This is where the Cepheids and RR Lyrae variable come in. For astronomers have learned to guage their actual luminosities—and hence their distances—simply by timing their pulsations.

The Cepheid Story

IN 1910 Miss Henrietta Leavitt of Harvard College Observatory began studying some 1700 variable stars that had recently been photographed in the Magellanic Clouds, those two "satellite" galaxies of the Milky Way some 150,000 lightyears from the Sun. (Although at that time their distance was not known.) She discovered that for Cepheid variables, the longer the period of pulsation—the time from one peak of brightness to the next—the brighter was the star's apparent magnitude. For example, a Cepheid with a period of 100 days was three magnitudes brighter, over-all, than a 10-day Cepheid.

Ejnar Hertzsprung (Netherlands) and Harlow Shapley (U.S.) seized on this information and made an all-important simplifying assumption. They assumed that the Cepheids in the Magellanic Clouds were, to all intents and purposes, all at the same distance from Earth Obviously they are not, but since the Clouds as a whole are so distant from us individual differences from one star to the next are negligibly small. This is like saying that everyone in Hawaii is at the same distance from San Francisco; it's not quite true, but it is close enough.

The importance of the Hertzsprung-Shapley assumption was this: it eliminated the effect of distance on the period-luminosity relationship of the Cepheids It meant that the real luminosity of a Cepheid changed with its period of pulsation. In other words, astronomers could now say that all 100-day Cepheids are three magnitudes brighter than all 10-day Cepheids. Anywhere in the universe! Regardless of how dim or bright the Cepheids might appear from Earth, their actual luminosity could now be determined by timing their pulsations.

The astronomers now had a scale that allowed them to rate the relative luminosities of these variable stars. If they could put a distance value to the scale—by getting the distance to any Cepheid, anywhere, of any brightness—then they could determine the distance of all observable Cepheids merely by timing them.

With Shapley leading the way, the distances to several RR Lyrae stars and Cepheid variables were estimated by the mean parallax method (they are all much too distant for trigonometric parallax). The distances are not perfectly accurate, as we shall soon see, but they were good enough to allow astronomers to begin measuring the size of the Milky Way and the universe beyond.

The Galactic Yardstick

THE Cepheids proved to be a key tool in understanding the physical structure of the universe. In fairly quick order it was established that the Sun is off to one edge of the Milky Way, and that the galaxy's center is some 30,000 lightyears from us. The spiral "nebulas," thought by many astronomers to belong to the Milky Way, turned out to be separate galaxies, each containing billions of stars, distant from us by millions of lightyears.

Cepheids are so bright that they can be seen in some of the nearer galaxies, including the great spiral in Andromeda. By timing the Cepheids there, it was at first concluded that the Andromeda spiral was 750,000 lightyears away. In 1950, Walter Baade of Mt. Palomar Observatory discovered that the type of Cepheid used to calculate the distance to Andromeda was actually more than four times brighter than had been assumed. This meant that the spiral galaxy was more than twice as far away—its distance is now given as about two million lightyears.

There are enough galaxies within reach of the Cepheid technique to allow astronomers to set up a rough sort of brightness index for galaxies. Galaxies that are too far off to permit individual stars to be resolved—even the ultra-luminous Cepheids—are gauged on an over-all brightness scale. This assumes that all spiral galaxies, for example, have the same total intrinsic luminosity. A fainter spiral is therefore farther away than a brighter one, and the difference between their apparent brightnesses can be used as a rough estimate of their distances.

There is one type of star that is even brighter than a Cepheid, and thus can be seen over even greater distances—a supernova.

These cataclysmic explosions of stars are rare by human standards: about once every 500 years in a single galaxy. But with billions of galaxies within reach of our telescopes, supernovae can be observed fairly often. While the Cepheids have a regular timing mechanism that allows them to be used as mileposts, supernovae evidently all blaze forth at about the same intensity. When an astronomer sees a supernova, then, he assumes that its intrinsic luminosity is the same as all supernovae (to within a few percent), and that its apparent brightness is a function of its distance.

To the Edge of the Universe

IN the 1920's astronomers discovered that the farther galaxies are apparently moving away from the Milky Way at speeds that increase with distance. The American, Edwin P. Hubble, showed that the galaxies are moving away in a smooth and predictable manner. The universe, therefore, seems to be expanding.

The expanding-universe conclusion is drawn from the red-shift of the spectra taken of the distant galaxies. Without going into the details of spectroscopy, we can simply say that when a luminous object is moving away from us, its spectrum is shifted toward the red. A spectrum shifted toward the blue shows that the object is approaching. This is nothing more than a Doppler affect, similar to the familiar change in pitch of a train whistle as it first approaches, and then fades off into the distance. The faster a galaxy is moving away from us, Hubble and others concluded, the farther distant it is from Earth. Thus the amount of red-shift in the galaxy's spectrum can be used as an indication of its distance.

To date, the farthest object to be definitely recorded is the radio source 3C 147 (the 3C stands for the Third Cambridge Catalogue of strong radio sources in the heavens). Radio-telescopes first picked up 3C 147. The 200-inch Mt. Palomar telescope, directed by the radio findings, has recorded a pinpoint of light that looks like an individual star in our own galaxy. However, 3C 147 shows a red-shift that indicates it is receding from the Milky Way at nearly half the speed of light. Its distance, then, is estimated to be between 5 and 10 billion lightyears.

And there we stand. From the surveyor's triangle to the edge of the known universe. And no end yet in sight.

It may sound slightly presumptuous to call some of these techniques "measurements." Clearly, the timing of a star's pulsation or the estimation of a

(Cont. on page 130)

BAIT

By CHARLES L. FONTENAY

She was only a woman, but she carried the seeds of destruction for an empire.

THE defense screens showed the Zyganian space fleet only six hours away.

But the tiny Solar Federation ship already was landing at the doomed spaceport on Alpha Centauri VI.

"Stupid, stupid, stupid!" snarled General Winburg, commander of the Solar outpost. "Whatever the weapon is, it can't be mounted in six hours."

Pleane, the Solar System Strategic Services officer, smiled but said nothing. However little Winburg liked it, Winburg had to follow his orders in this case.

The two, with an assortment of lesser-ranking aides, waited on the windswept runways of the spaceport as the airlock of the little Solar Federation cruiser swung open and the landing ramp rolled out. Pleane's briefing had gone only so far. He was as surprised as Winburg when the central figure of the group of half a dozen emerging from the cruiser was seen to be a woman.

They stepped forward to greet the landing party. They introduced themselves

"I am Mary Tewhowa," said the woman, holding out a slim hand "I'm the Solar Federation agent."

"Mary," repeated Pleane, holding her hand and gazing into the dark-skinned face. "It's an old-fashioned name, but appropriate. You're a brave woman, my child."

She smiled.

"People have to be brave in war," she answered quietly.

"The Zyganians are human, and I don't believe you'll be badly treated," said Pleane. "They know you hold a secret, and you must hold out against their questioning as long as you can. Time is the most important factor."

"I understand that," she said. "You're sure the . . . weapon . . . will be effective against them?"

"Certain," said Pleane. "Like other interstellar humans, the Zyganians' ancestors were from Earth. The 'weapon' stayed on Earth, and eventually the Zyganians lost the knowledge that could defend against it. We're sure it will weaken this fleet so our ships can move in and make a capture. Without it, we aren't strong enough to keep them from moving against the Solar System itself."

"Then, whatever sacrifice is required of me is worthwhile," she said.

The aides took over the duty of escorting her, and she moved away toward the humped buildings of the base—a base that soon would surrender without a fight to the Zyganians. Pleane and Winburg stood looking after her for a few moments, then followed the cruiser's crew into the little ship.

The rocket engines roared and the ship lifted.

"I don't like leaving my men here, even to join the Solar System fleet," said Winburg glumly. "A commander should stay with his men."

"You know too much of our strategy to permit your capture," answered Pleane. "It's necessary that neither of us be here when the Zyganians arrive."

"I know too much!" exploded Winburg. "I know too much! This woman comes here with the secret of a new weapon, and you allow her to be captured, deliberately. And you say I know too much!"

"The weapon is not what she knows, but what she is," answered Pleane. "Mary Tewhowa is what once on Earth would have been called 'a typhoid carrier'."

THE END

(cont. from page 128

galaxy's luminosity is not a direct measurment of distance. All of our knowledge rests on slender threads of logic and induction. None of it is infallible, and a lot of it is little more than educated guesswork. No one knows this better than the astronomers themselves.

But in years to come, when astronomy breaks free of the Earth's surface and murky atmosphere, we may be able to make parallax measurements from opposite ends of the solar system, or see "milepost stars" in much more remote galaxies, or use the newly-emerging techniques of x-ray and ultraviolet astronomy to make better and farther-reaching distance measurements. In the meantime, an astronomer can only say, "It is better to use a candle (even though it may be inexactly calibrated) than to curse the darkness."

■

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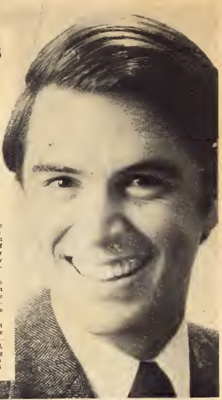

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